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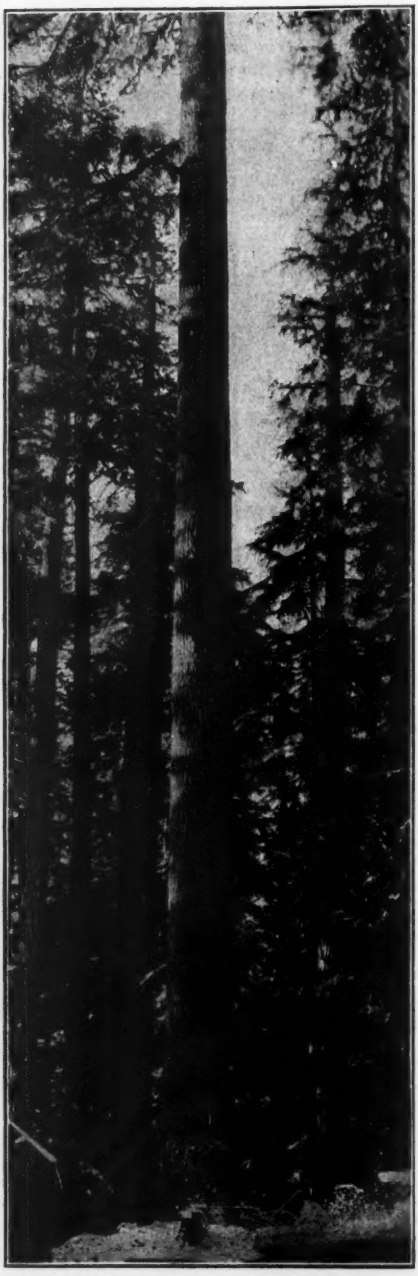

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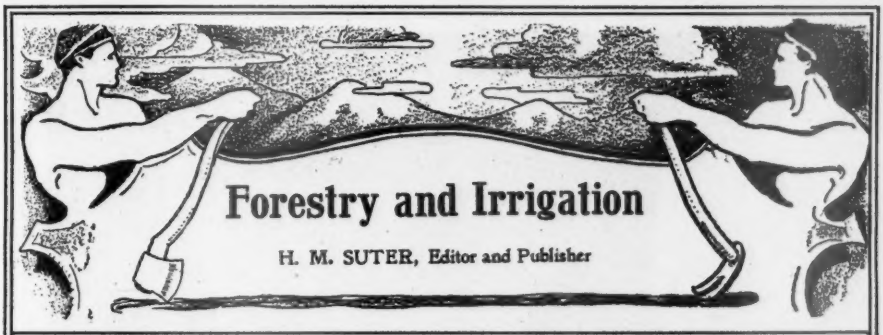

Forestry and Irrigation

H. M. SUTER, Editor and Publisher

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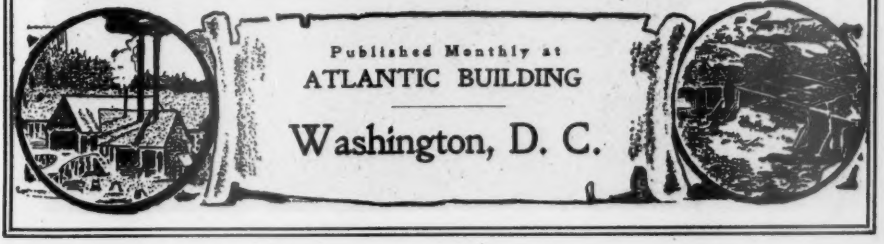

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WORK OF FIRE ABOUT RESERVOIR NO. 2 OF THE COLORADO SPRINGS WATER SYSTEM. ALTITUDE, 11,300 FEET. CAPACITY, 97 MILLION GALLONS. MOUNT GARFIELD APPEARS IN THE BACKGROUND. (SEE PAGE 169.)

Forestry and Irrigation.

VOL. X. APRIL, 1904. No. 4.

NEWS AND NOTES.

Prospective Legislation at Albany. The Senate Committee on Forestry, Fish, and Game is making a sturdy fight for needed improvements in the New York State laws. After a good deal of preliminary investigation, the following measures were introduced and are now well on their way in the Legislature :

The Parks. A bill (Senate 800) definitely settling and extending the limits of the Adirondack Park.

A bill (Senate 730) creating a forest park in the Catskill Mountain region and defining its boundaries. This, like the Adirondack Park, is to be "forever reserved and maintained for the free use of all the people."

Concerning Fire. A bill (Senate 873) amending the former law relating to forest fire protection in the following valuable points :

The number of foresters who may be employed is no longer limited.

The Commissioner of Forests may appoint five assistant wardens, at least four of whom shall be employed during the fire season in watching the steam railroads in the Adirondack Park and inspecting locomotives.

Any fire warden may, with the approval of the Commission, establish a fire patrol during a season of drought.

Railroads in the forest preserve must remove all combustibles from the right of way at least twice a year, and additionally whenever required by the commissioner.

Locomotives must be provided with the best form of spark-arresters and the railways may be compelled to adopt any additional devices and precautions against fire which the commissioner requires in the interest of the public.

Any railroad employé is liable to $100 fine for any violation of the fire laws occurring through his neglect, and, in addition, the company is liable to a fine of $100 per day for each day the violation continues.

The right of the state to recover damages from fire is so extended that recovery shall be had to the distance of five miles from the place where the fire was set, notwithstanding the fire may have extended to the state lands by crossing one or more intervening tracts.

Co-operative Work. A clause in the Annual Supply Bill appropriating $10,000 for defining, classifying, and describing the forests in the forest preserve in conjunction with the Bureau of Forestry, provided that an equal expenditure shall be made for the purpose by the Department of Agriculture.

Constitutional Amendment. Lastly, a concurrent resolution of the Senate and Assembly proposes to amend the state constitution so that dead timber on burned areas may be removed so far as necessary for reforestation by officers of the state, but not by contract.

State lands outside the newly established limits of the two forest parks may be sold and the proceeds used for the purchase of lands within them.

It Might Have Been Worse. If Senator Brown can now secure the passage of these measures he will deserve the hearty commendation of his fellow-citizens. He has probably outlined all he thought possible to gain, and in this his generalship may not be doubted, but it must be confessed that the proposed amendment to the constitution is a disappointment. We had

hoped for a repeal of the clause which prevents the state from taking care of its own property. If the amendment goes through, which is by no means certain, state forestry will still be restricted to planting. Care of living woodlands, beyond the negative work of preventing their destruction by fire, is still unprovided for. This will necessitate another amendment in the not far distant future. Why make two bites of a not unreasonably large cherry?

Forest Reserve Personals. Mr. James H. Clarke, of Denver, has been appointed Forest Superintendent of the Pike's Peak group of Forest Reserves, *vice* Mr. Henry Michelsen, deceased.

The position of Forest Superintendent in Arizona and New Mexico has been abolished, in accordance with the purpose of the Secretary of the Interior to discontinue this class of official positions as rapidly as circumstances will permit.

Forest Superintendent J. B. Hanna is transferred, to become Forest Supervisor of the Pecos River Forest Reserve in New Mexico.

Forest Reserves and "Varmints." The following communication in a recent number of *Forest and Stream* refutes a previous argument against extension of the forest reserves:

"*Editor Forest and Stream:*

"I have read a letter published in your last number concerning 'Wyoming Wolves and the Forest Reserve,' in which it is stated that 'there is no doubt but the reserve will become a breeding place for wolves, coyotes, and cougars, thus leading to greater friction between the reserve and the stockmen.'

"There is no reason why animals of this kind should increase in consequence of these mountains having been taken within the Yellowstone Forest Reserve.

"Since the creation of this reserve no change has been made in conditions that would tend in any way to this result. There has been no decrease in the number of settlers or diminution in the amount of stock ranged upon the reserve. The same game laws exist there as in any other portion of the state, and are most efficiently enforced by the forest rangers, who are also state game wardens. Hunters and trappers desiring to capture mountain lions, wolves, or coyotes are in no way interfered with, but, on the contrary, have every facility and opportunity for the capture of these animals upon the reserve as elsewhere. The state bounty paid on wolves applies equally to those killed on the reserve as off the reserve.

"The reserve officials recognize that mountain lions and wolves are a great menace, not only to game, but to the stock of the settlers, and the rangers, armed and constantly patrolling the reserve, are instructed to destroy at every opportunity 'varmints' of this kind. A number of wolves have already been killed by the rangers.

"A pack of dogs is now being raised for the purpose of hunting mountain lions upon the reserve.

"Many reports, without foundation, have been circulated regarding this, as well as other conditions connected with the forest reserve, with intention of stirring up opposition to the reserve. An article published in a Wyoming paper last year stated that a trapper named Lyons, going upon the reserve to hunt wolves, had been disarmed by a ranger. The department now has an affidavit, both from the ranger and from Mr. Henry Lyons, stating that the report was absolutely false.

"Thus you see a desire to create a prejudice against forest reserves on this point is entirely unwarranted.

"Settlers in our state, realizing the necessity of timber and water protection, and also realizing that the reserve was created and is being administered for their benefit, not only is all opposition disappearing, but they are rendering most valuable aid in assisting the forest officers in carrying out the rules and regulations of the Department.

"A. A. ANDERSON,
"*Special Superintendent*
"*Yellowstone Forest Reserve.*"

Anderson Contradicted. *Forest and Stream* for April 2 contains the following reply to the Forest Superintendent's letter:

"*Editor Forest and Stream:*

"In Mr. Anderson's letter such astounding statements occur that I can not let them pass unchallenged.

"He says that there is no decrease in the number of settlers by reason of the reserve. The best answer to Mr. Anderson is found in the fact that wherever one goes on the reserve are found abandoned ranches, tumble-down fences, filled up irrigation ditches, and deserted houses on which appears the notice, 'This building has been taken possession of by, and is the property of, the United States, and all persons are hereby warned against trespassing therein.'

"As to Mr. Anderson's statement, that the same amount of stock is on the reserve as formerly, I challenge him to publish the amount actually allowed on the reserve as against those kept off. Last summer tens of thousands of acres of grass went to waste, though the stock was ready to eat it, and this winter thousands of tons of hay have been sold for the cost of putting it up, or are rotting in the stacks, simply because the stock cannot be summered on the reserve. I expect to burn 200 tons of standing hay next fall that should be worth six dollars a ton; and on hundreds of acres of land I shall not even turn the water, because of Mr. Anderson's management of the reserve.

"As to the reserve becoming a breeding ground for wild animals, here are the facts: Here is a great tract of mountain country, thinly settled, and intended to be kept so. It is well stocked with game to furnish food, and every attempt is being made to have as little hunting done thereon as possible. The cougars are already there, and the wolves have found out its advantages and are coming in droves.

"With the boundaries restricted to the actual forest and mountain lands, and with a man in charge well informed as to actual conditions and who possesses the respect and confidence of the people, much might be done. As it is, the situation is bad. A heavy blow has been struck at the development of Wyoming, and very little good accomplished. The forests could have been protected just as well with a much smaller reserve. These forests are mainly of lodgepole pine, are of very little commercial value, and were in no danger until railroads came.

"Nothing has been done toward the main object of game protection, to save the larger males, so as to provide trophies that are worth going after. Bull elk scalps are worth $8 to $15; bull elk tusks, $2 to $5 each; mountain sheep scalps $3 to $8; and from $50 to $500 for extra large elk and sheep heads. And if anyone thinks that no elk and sheep are killed at these prices, they are mistaken. For the next two months is the hunters' harvest. The big bulls and rams are weak and are bunched in sheltered places.

"I can leave home tomorrow morning and before night have a hundred dollars' worth of elk tusks in my pocket, and in a month can have a thousand dollars' worth of heads cached, ready to pack out in the spring, and no one the wiser. And I don't know but what I might just as well do it.

"WILLIAM WELLS.

"WELLS, WYOMING."

Where the Shoe Pinches. As usual, we have just enough of the facts from both sides to make one unacquainted with the situation give up the problem in despair. The following additional statements, which we have on good authority, may serve to throw some light on the subject.

Under Mr. Anderson's administration the game has been very carefully preserved. This was a necessary policy on account of the fact that the elk from the National Park drift southeastward through the reserve in search of winter feed, and right in their line of travel a number of men have taken squatter's claims, so high up in the mountains (8000 feet or more) that no sane man would have settled there for agricultural purposes.

As a result of a $40 non-resident license law and increased vigilance of the rangers, the business of head and tusk hunters has been much interfered with; hence the "deserted houses" mentioned, which are now used by the rangers. The *bona fide* settlers of Wyoming have suffered no injury.

Why Mr. Wells should be so rash as to burn his hay is difficult to understand, since there are plenty of cattle to eat it along the upper waters of the Green River.

The reserve has saved a great deal of timber which would otherwise have floated down the Green (Colorado) River in the form of ties. The old tie-cuttings within a few miles of Mr. Wells' home are sufficient evidence of the fate that formerly awaited the forest cover of this important basin.

It is quite possible that there are points for criticism in Mr. Anderson's administration. Few men are without a flaw, and the reserve system is too new to be perfect under all circumstances; but in nine cases out of ten it seems to be the rule that the men with strenuous objections are those who are no longer allowed to do as they please with the national land and timber and water and game.

Tennessee Forest Commission. An act of the last Legislature in Tennessee directed the Governor to appoint a State Forestry Commission, consisting of three members. In pursuance to this act Governor Frazier has lately selected Prof. C. A. Keffer, of Knoxville; Col. Hugh L. Bedford, of Bartlett, and Col. J. B. Killebrew, of Nashville.

The new commission met March 18 and elected Col. Killebrew chairman and Prof. Keffer secretary.

After a full interchange of opinions, it was decided that each Commissioner should prepare a report for his section of the State, with especial reference to the present acreage and conditions of the forests; the degree to which commercial species had been exhausted, and what practical methods could be employed in reforesting worn out lands. With these reports will be embodied the recommendations of the Commission for legislation to secure protection from fire and to encourage the reforesting of lands not useful for agricultural purposes.

"Adirondack" Murray Dead. Rev. William H. H. Murray, widely known for years as "Adirondack" Murray, died at his home in Guilford, Conn., March 3, aged 64.

He was one of the pioneers of the modern yearly invasion of the North Woods by an ever-growing army of recreation seekers, and his book, "Camp Life in the Adirondack Mountains," was the cause of much of the interest in this region, and of the soubriquet bestowed upon its author.

New Club Planned. With the advice and approval of Mr. Pinchot and others well known in the government forest and water service, a project is on foot to form a club in Washington from the field men of the Bureau of Forestry, the Reclamation Service, and possibly the Land Office and the Bureau of Soils.

There is no doubt that such an organization would be a very good thing for the men and for the service, provided the contemplated advantages can be secured for a reasonable rate of dues. There is plenty of good club material within the limits mentioned, but a large number of the men are not in a position to stand more than very moderate assessments cheerfully.

A committee consisting of Mr. J. B. Adams, Mr. Thomas Sherrard, Mr. George Woodruff, and Mr. Coert Du Bois, all of the Bureau of Forestry, are now engaged in looking up a suitable house and promise of membership sufficient to warrant the undertaking.

Canadian Forestry Association. The following papers were delivered at the fifth annual meeting of the Canadian Forestry Association, which was held in Toronto March 10 and 11: "Systems of Ad-

ministration of Timber Lands in Canada," Aubrey White, Assistant Commissioner of Crown Lands, Toronto, Ont.; "Forestry in Relation to Irrigation," J. S. Dennis, Superintendent of Irrigation of the Canadian Pacific Railway Company, Calgary, Alberta; "Forest Reproduction in Germany," Dr. A. Harold Unwin, of the Dominion Forestry Branch, Ottawa; "Forest Management," John Bertram, President Dominion Transportation Commission; "Forestry Education," John Loudon, M. A., LL. D., President Toronto University; "Some Ontario Forestry Problems," Prof. H. L. Hutt, Guelph.

A banquet was held at the King Edward Hotel on the evening of March 10, at which speeches were delivered by prominent public men.

On the invitation of E. G. Joly de Lotbinière, it was decided to make Quebec the next place of meeting.

Society of American Foresters. At the residence of Mr. Pinchot, March 10, Dr. von Schrenck gave a most interesting discussion of the work which he is directing in various parts of the United States in experimenting on the chemical treatment of inferior woods to lengthen their useful period as railway ties, poles, posts, cross-arms, and piles.

Mr. George Woodruff, Attorney of the Bureau of Forestry, spoke briefly of the various land laws which are a matter of such interest and importance as regards matters of forest and water conservation in the West.

At the usual Thursday meeting of the Society, held March 24, at the residence of the Forester, Mr. Olmstead and Mr. Allen talked briefly of forest-reserve matters.

Mr. Olmstead, confining his remarks to Arizona, urged that in this territory the utmost care should be exercised in husbanding the timber and other forest resources, and that grazing should be most carefully regulated, since a satisfactory new growth is secured only with difficulty on account of climatic conditions, and the soil is so friable that when rain does occur erosion is excessive and irrigation reservoirs are eventually clogged with silt.

Mr. Allen, speaking of Idaho, Montana, and Colorado, said that in the northern country the greatest value of forest reserves lies, as in Arizona, in their power to conserve water and soil. There are, however, a few forested areas in which the value of the timber itself is the prime consideration, since if these were stripped, and the timber exported, the local mines could not be developed.

Nevertheless, in one section mining men are afraid to support, publicly, the fact that they desire the timber near them reserved, because the implication that the supply is exhaustible would injure their stocks.

He advanced the opinion that many of the new reserves should be held without applying many of the present reserve regulations until Congress furnishes funds sufficient to give them a ranger service adequate to enforce such regulations satisfactorily.

This opinion is based on observations that local hostility is frequently due, not to the reserves themselves, but to inefficient administration.

Reports of Fires. Severe forest fires are reported from Georgia and South Carolina during the last two weeks of March.

In the first week Kansas and Oklahoma suffered from prairie fires which swept the remaining feed from the range, destroyed farms, threatened villages, and killed five persons. Hundreds were made destitute.

Forestry Lectures. It is announced that Mr. Overton W. Price, Assistant Forester of the U. S. Department of Agriculture, will deliver a series of four lectures before the senior class of the Yale Forest School, covering the organization of the field-work of the Bureau of Forestry, the point of view of the Bureau toward its field-work, and an outline of the methods under which field-work is carried on.

These lectures will be given at Milford, Pennsylvania, during the last week of this month.

Thousands of New Homes. Nevada will soon have one of the largest irrigation systems in the world. Mr. L. H. Taylor, District Engineer for the United States Reclamation Service for Nevada, has recently been in Washington and reports the satisfactory progress of the Truckee-Carson reclamation project, of which he has immediate charge.

This project contemplates the utilization of the waters of the Truckee and Carson rivers for the irrigation of about 375,000 acres of sage brush desert in western Nevada. These lands will furnish homesteads of about 80 acres each for about 4,500 families. It is expected that, with the addition of the towns and villages that will naturally spring up in the district, the population of the state will be increased in the next few years by at least 60,000 people.

Active construction is now in progress on a main canal about 31 miles long, which is to divert the waters of Truckee River to a large storage reservoir on the lower Carson River. There the waters of the two streams will be mingled and impounded, and thence led out upon the plains in the vicinity of the Carson and Humboldt Sink. Two contracts for the construction of different divisions of this canal were made by the Secretary of the Interior with E. B. and A. L. Stone Company and C. A. Warren & Co., California contracting firms, on August 28 and September 3, 1903, respectively. Ground was broken on September 11, 1903, and the work is to be finished by November of the present year. In the meantime, surveys for the requisite system of distributing canals are well under way, and the department will be ready in the spring to contract for their construction. This work will be followed by the erection of a dam which will form the reservoir on the Carson River. The reservoir will have a total length of about 18 miles and will flood over 10,000 acres of land to an average depth of 28 feet.

The lands to be irrigated by these works aggregate about 300,000 acres, situated in the lower portions of the Truckee, Carson, and Humboldt River basins. In the upper valley of the Truckee and Carson rivers some 75,000 acres of additional land will be supplied from works to be constructed some time in the future. As these great areas are gradually brought under cultivation, and a greater water supply is required, ten additional reservoirs, including Lake Tahoe, are to be added.

Tree Surgery. Careful horticulturists treat a cavity in the trunk of an orchard tree much as a dentist treats a hollow tooth. The cavities are due to the work of fungi whose spores find lodgment in any wound in the bark, especially such injuries as the tearing out or careless pruning of a branch. The fungi attack the living tissues and rapidly enlarge the hole by the decay of surrounding portions of the wood. All the decayed wood is grubbed out as far as possible with a gouge or scraper. The clean surface within the cavity should be painted with coal tar, to kill any germ of decay that might remain, and the hole finally filled with Portland cement, tamping-in firmly and smoothly on the outside flush with the edges of the cavity. The new bark will then begin to close over the cement, and, if the tree has vigor enough, will finally completely cover it. The cement prevents water from accumulating in the cavity, which goes a long way toward preventing the lodgment and growth of the spores.

In foreign forests under careful management the trees which show injury of this nature receive the treatment mentioned or some equivalent process.

The oaks on the campus of the University of California have been treated in this way for a number of years, with very satisfactory results.

Tangled in the Foliage. At the live-stock show recently held in Chicago Secretary of Agriculture James Wilson was one of the speakers at a mass meeting of cattlemen. Behind him on the same platform, relates the *New York Herald*, somewhat screened from observation, sat Norman J. Col-

man, the first man to hold the portfolio of agriculture.

Secretary Wilson made a happy speech, and because of his popularity with the western ruralist he was the shining, central figure of the gathering. When he had finished talking, lusty lungs and sunburned hands gave him noisy approbation. The applause had not ceased when a Nebraska farmer, with whiskers like Senator Peffer's, arose in the back of the hall and said:

"Gentlemen, we are all mighty glad to hear Secretary Wilson and are ready to do him honor; but let us not forget the other great men we have with us. We have on the same platform to-night the Alfalfa and Omega of agriculture"—

It was as far as the speaker ever got. His few remaining words were lost in the shrieks of laughter.

At Biltmore. Mr. P. P. Pelton, of the Biltmore Forest School, writes that Dr. Schenck has been experimenting with a method of storing acorns over winter with a view to preparing them for more rapid starting of growth when planted.

Just beneath the outtake at fish hatchery No. 1, a large wire-netting box was placed, through which the escaping water flowed constantly. In this box, when cold weather came, were placed a couple of bushels of acorns. All through the winter an unceasing stream of cold water has poured over them. The idea, of course, is the maintenance of a constant temperature and air supply.

Much trouble has been experienced in obtaining in sufficient quantities a proper covering for newly planted seed beds during the winter season. Of the several materials used, one that seems to be unusually good is old, weather-beaten burlap. It forms a good cover and is easily removed in the spring.

Another point of interest is the use of well rotted sawdust as a top dressing between rows of seedlings during the winter. The results are excellent. The sawdust keeps the temperature as even as does manure. It prevents "boosting" of the young plants by frost, and will be allowed to remain on the beds during the summer as a protection against evaporation. It acts to some extent as a fertilizer and its cost is trifling.

Kansans' Meeting. The State Horticultural Society of Kansas will hold a special meeting at Dodge City, Kansas, May 11 and 12, which will be devoted entirely to forestry and irrigation.

The Bureau of Forestry will be represented by Mr. William L. Hall, who will speak on "The Progress of Forestry in the United States," and Mr. R. S. Kellogg, who will discuss "Forest Planting in Western Kansas."

Mr. M. C. Hinderlider, of the U. S. Geological Survey, will talk of the work of the Reclamation Service.

The program is not yet completed, but it is announced that a number of prominent Kansans who are well informed on these matters will take part.

This meeting should be one of great interest, and it is hoped that a large attendance will carry its benefits through a wide range of influence.

To Buy Reservoir Site. Another step has been taken toward the transformation of the arid West. The Secretary of the Interior has authorized the purchase of the Hondo reservoir site in New Mexico for the sum of $20,000. It is in Chaves county, about 12 miles west of Roswell.

The site of this proposed reservoir is a natural depression, which, with a small amount of enbankment, can be given a capacity of 40,000 acre-feet. This will hold practically all the water that the Hondo will furnish during low-water years. It is proposed to store here the flood waters of this stream and draw on them through lateral canals for irrigating the lands below the reservoir.

The lands that will be benefited by the reservoir waters are naturally fertile and may be easily irrigated at slight expense. They are free from alkali and will be ultimately worth at least $100 an acre when planted to alfalfa

and corn. If used for fruit growing, to which they are specially adapted, they may have a far greater value.

No engineering difficulties are expected in the work. The natural reservoir will have to be enlarged and canals built for the inlet and outlet of the waters. It is estimated that the cost of constructing the reservoir and bringing the water to the arid lands will approximate $240,000, or $20 an acre for a minimum acreage of 12,000. It is believed, however, that nearly 15,000 acres will be served.

Destruction of Italian Cork Forests. While Spain still furnishes 32,800 tons of cork annually, the production of Italy has decreased to 4,000 tons. The value of the Spanish exports of cork amounts to $6,000,000 per year, against less than $250,000 for Italy. Only Sicily and Sardinia are still producing cork to any considerable extent in Italy, while the former great oak forests of Calabria are almost totally destroyed. It seems incomprehensible that this destruction has been permitted. The trees easily reach an age of two hundred years. They yield cork in their thirtieth year and continue to do so every seven years. Seventy-five years ago the English demand for cork was supplied exclusively from Italy. The destruction of the remaining forests goes on uninterruptedly, and nobody seems to try to prevent it or to plant new trees. Italy has the most favorable soil and climate possible for this industry, the volcanic soil of the peninsula being considered an important factor in the development of high-grade cork.

Water and Forest Convention. The annual meeting of the California Water and Forest Association will take place April 22 at the rooms of the Chamber of Commerce, San Francisco.

Reports are expected from the government officials who have charge of the coöperative forestry work carried on by the state and the United States. The prospects for further accomplishment and the necessity for further appropriations will be matters for discussion.

Nebraska Planting Resumed. Mr. C. A. Scott writes from the planting reserve at Halsey, Nebraska, March 20.

"Everything here has wintered in fine condition. We sustained a slight loss in seedling jack pine and the California species, but in general the seedlings wintered well.

"For two weeks the weather has been favorable, and we have already planted about 10 acres of sandhills, and have the ground plowed for our nursery rows. The planting is done with seed from hand corn-planters. I have three student assistants and one laborer at present."

Hydrology in California. The U. S. Geological Survey is investigating the underground water resources of the Southwest. In southwestern California, where the surface streams have been highly developed, the hope of future increase in the water supply can only be found in the underground waters. During the past year Mr. Homer Hamlin has compiled records of the wells and is making a study of the extent of the artesian basins. Extensive experiments have been carried on to determine the velocity of the underground waters by actual measurement of the rate of flow. Investigations are also being made by Mr. W. C. Mendenhall, geologist, the idea being to combine an engineering and geological study of these situations.

All the wells in the district are being located upon topographic maps, the depth of water determined, and the output and elevation of the water plain contoured upon the topographic map, which will probably be issued within a few months. Records have been compiled from over 5,000 wells. It is believed in many districts of southern California there has been an overdevelopment of these underground waters,

which, if unrestrained, will lead to the exhaustion of the supply. It is particularly desirable that the relation between the actual inflow and the actual output should be determined. Any increase in the amount of the ground waters absorbed by the diversion of the streams over gravel beds in midwinter would be of marked benefit by increasing the water supply available from the wells in midsummer.

Big Working Plans. Mr. Frederick Weyerhaeuser, president of the Weyerhaeuser Timber Company, has signed an agreement with the Bureau of Forestry by which the Bureau agrees to prepare working plans for the conservative management of about 1,300,000 acres of the company's timber lands in Washington.

The Northern Pacific Railway Company has also requested that the Bureau of Forestry prepare working plans for its enormous timber land holdings in Washington and Idaho.

The timber lands of the Weyerhaeuser and the Northern Pacific Companies are the most extensive privately owned tracts of land for which the Bureau of Forestry has ever been asked to prepare working plans. The field work will begin next summer. How long it will continue before figures enough are secured on which to base plans intelligently it is impossible at present to state. The task of putting all these lands under careful management is of great magnitude, and only one familiar with the natnre of the forests of the Northwest can appreciate its difficulties. But great as these difficulties are, the importance and value of the work, once accomplished, far outweigh them. It is another proof of the profound interest and confidence which the West has come to feel in the practical results of forestry that the two greatest land-holding companies of the Pacific coast and Rocky Mountain States, the one representative of the lumber, the other of the railroad interests of that country, should have called on the Bureau of Forestry for expert advice in managing their lands. The main timber supply of the United States is contained in the Northwestern States, and the great advances which forestry has made in that part of the country must be regarded everywhere as of general benefit.

The Agreement. The following is the text of the agreement under which the Bureau of Forestry is to prepare working plans for the Weyerhaeuser Company:

The Department of Agriculture of the United States and Weyerhaeuser Timber Company of St. Paul, county of Ramsey, State of Minnesota, mutually agree together as follows:

1. The Department of Agriculture, in pursuance of investigations in forestry and in order to disseminate a knowledge of improved ways of handling forest lands, shall, after personal study on the ground by its agent or agents, prepare a plan for harvesting the forest crop and reproducing the forest on the land of the said Weyerhaeuser Timber Company, situated and described as follows: 1,300,000 acres, more or less, State of Washington.

2. The said plan shall be prepared for the purpose of promoting and increasing the present value and usefulness of the said land to its owner, and to perpetuate and improve the forest upon it.

3. Upon the completion of the said plan and its acceptance by the said Weyerhaeuser Timber Company, the Department of Agriculture shall supervise the execution thereof so far as may be necessary.

4. The cost of executing the provisions of this agreement shall be paid as follows:

(*a*) The salaries of all the employés of the Department of Agriculture engaged in fulfilling this agreement shall be paid by the department.

(*b*) A preliminary visit of inspection, if required, shall be wholly at the charge of the department.

(*c*) Actual and necessary expenses for traveling and subsistence of the agent or agents of the department working under this agreement, except as provided in the foregoing paragraph (*b*),

shall be paid by the said Weyerhaeuser Timber Company. What are "actual and necessary expenses" shall be determined by the printed regulations of the department. Expenses under this paragraph (*c*) are estimated, for the preparation of this working plan, at five thousand (5,000) dollars.

(*d*) Necessary assistants shall be furnished by the said Weyerhaeuser Timber Company without cost to the department. It is estimated that —— such assistants will be required for —— to prepare this working plan.

(*e*) The department shall not participate in any degree in the receipts and expenses arising from said land, except as above provided.

5. The Department of Agriculture shall have the right to publish and distribute the said plan and its results for the information of lumbermen, forest-owners, and others whom it may concern.

6. This agreement may be dissolved by either party upon ten days' notice given to the other.

Eastern View of Irrigation. The following communication, recently published in the New York *Times*, is likely to be of interest to readers of FORESTRY AND IRRIGATION:

To the Editor of the New York Times:

From a recent report made by the Agricultural Department at Washington we learn that our crops of corn, wheat, oats, barley, rye, buckwheat, flaxseed, potatoes, and hay for 1903 were raised upon 215,000,000 acres of land, or 11 per cent of the area of the republic, not including Alaska. The farm value of these crops is placed at $3,000,000,000, or at the rate of $13.70 per acre. Wheat was valued at 62½ cents per bushel, and other crops in proportion.

Engineers who have made a study of irrigation and of our arid lands west of the Mississippi claim that 100,000,000 acres can be reclaimed by irrigation, and made highly productive lands, which command at all times and seasons an abundant supply of water, and will yield larger and more uniform crops than land in the valley of the Mississippi dependent upon the rainfall.

Irrigated lands in California sell for from $100 to $1,000 per acre, and have been sold for $1,800. In Colorado this season 710 tons of sugar beets were produced upon 29 acres of irrigated land, and were sold to a sugar refinery for $3,195. Irrigated lands planted with fruit trees, grapes, oranges, almonds, and small fruits often yield $1,000 per acre. A conservative value of 100,000,000 acres of irrigated land in our trans-Mississippi and Pacific States would be $10,000,000,000, or $100 per acre. The annual value of the products should be not less than $25 per acre, or a total value of $2,500,000,000.

Ten billions added to the accumulated wealth of the nation in the form of productive land, yielding an income of $2,500,000,000, will give stability to our investments in railways, steamships, and manufactories. The reclamation of these lands involves no entangling international problems to solve, nor should their reclamation be made a question of party politics. It is a problem for the nation to solve, and not the states or private corporations.

The Empire of Germany and the Republic of France have an area of 263,000,000 acres and a population of 93,000,000. If we assume that 40 per cent of their lands are under tillage, their crops of food products named above are raised upon 105,200,000 acres of land. They produced in 1900 400,000,000 bushels of wheat, 400,000,000 bushels of rye, and 30,000,000 tons of sugar beets and other crops for the support of 93,000,000 people.

The reclamation of our arid lands means a vast and permanent enlargement of our home market for the product of our industrial establishments. Irrigated lands will repay intensive cultivation because the returns from such lands are large and constant; that means increased employment for unskilled labor. There is no dark or doubtful side in the solution of the reclamation of our arid lands. No class will be injured. On the contrary, all classes will be benefited.

FRANCIS WAYLAND GLEN.

MR. JOSEPH BARLOW LIPPINCOTT,

ONE OF THE LEADING ENGINEERS OF THE UNITED STATES RECLAMATION SERVICE.

JOSEPH BARLOW LIPPINCOTT, as a supervising engineer in the Reclamation Service, in charge of its California work, occupies a position of extreme importance. In addition to decided ability as an engineer and wide experience in his calling, Mr. Lippincott has an intimate knowledge of the water resources of the State of California. He was born at Scranton, Pennsylvania, October 10, 1864, and educated at Dickinson College, Pennsylvania, and the University of Kansas, receiving the degree of B. S. in 1886. Since that time he has been continuously engaged in civil engineering. In July, 1888, he was employed by the U. S. Geological Survey for topographic work, and continued until 1892, when he was appointed assistant engineer for the Bear Valley Irrigation Company, of Redlands, California, and assisted in building a portion of the Santa Ana Canal. In 1893 he took charge of the field work of an enterprise contemplating the irrigation of 30,000 acres in the northwestern portion of Los Angeles County, California. This work was abandoned in December, 1894. In January, 1895, he was placed in charge of the hydrographic investigations for the U. S. Geological Survey in California, and has had charge of this work to date. Mr. Lippincott, in addition to his field work, is also the author of various U. S. Geological Survey publications. He has been employed on domestic waterworks of various cities, including San Francisco, Los Angeles, and Santa Barbara, California, as consulting engineer, and also in the same capacity by a number of irrigation companies. Mr. Lippincott has reached his present high position at an early age, and the people are thus assured of his services in this great work for some time to come.

THE PHILIPPINE FORESTRY SERVICE.

SOME NOTES ON THE LIFE AND WORK OF AMERICAN FORESTERS IN THE FAR EAST.

BY

W. KLEMME, FORESTER.

THE personnel of the Forestry Bureau has been decidedly augmented during the past two years, and at present numbers over two hundred men, who receive an annual remuneration of about $219,000, Philippine currency.

Of the employees in the provinces, the greater number are Filipinos. The whole force possesses but six educated foresters, and the need of Americans, as well as natives, who have a practical knowledge of this profession is at all times pressing. It is not meant by this a superficial preparation, nor even a personal attraction for the life, but one based upon serious application and practical knowledge of sound methods.

As regards remuneration, foresters receive, on appointment, $100 (gold) per month, subject to gradual increase, on proof of efficiency, to $200 (gold) per month. Since they spend the major part of the time in the field, where the bulk of expense is borne by the Bureau, they are enabled to save money, providing, of course, that the necessary disposition to do so exists. In the city of Manila prices are exorbitant, but one can live there quite comfortably for $100 (gold) a month.

The intention of remaining in the service several years should exist. Conditions in the archipelago are so different from those in more temperate climes that even a forester with valuable experience has much to learn, and it goes without saying that his resignation at a time when his services have become valuable to the Bureau cannot meet its approbation.

CLIMATIC CONDITIONS.

The life of a forester in these islands is one of infinite variety, much educational experience, and large possibilities. The hardships and inconveniences are those incident to exposure to the elements and life in an undeveloped country. Among them may be mentioned isolation, infrequency of mail service, and the number of the dialects spoken by the natives, for each province has its own language.

During the rainy season, which extends from June to November, there is a steady and at times disheartening down-

HAGACHAC TREE, 115 FEET IN CLEAR LENGTH.*

*Hagadhad (*Dipterocarpus sp.*)?

pour. Frequently the forester sits in his tent or nipa hut while rain is percolating through all surrounding objects—papers, instruments, provisions, and blankets. Under such conditions patience has heavy drafts falling due and good humor flies to a premium. Patience is especially necessary, as the natives, like all inhabitants of tropical countries, are slow and adverse to work as long as they have plenty of rice and a few fish; but if one considers their peculiarities, he can get along with them very well. No trouble has been encountered by the writer during the two years' work in the provinces.

In the field the mean temperature is pleasant. It seldom becomes oppressively warm and never cold. The nights are always refreshingly cool. Woolen blankets are necessary, and often during the winter months two of them can be used and a rain coat added with comfort.

CALIPERING.

Each forester is in charge of a district, usually one province. As the number of men engaged at present in this work is not sufficient to cover the Archipelago, districts have been selected where timber cutting is most in progress. The main duty of the forester is inspecting the work in the woods and marking timber for felling, but, in addition, he has control of the native rangers. A report of daily operations is, however, sent direct to the main office.

The marking of trees is necessarily a slow and tedious process, and it is hoped that before long rangers will be able to do the greater part of it. This would permit the forester to assume control over a wider range and confine personal work to inspection and supervision, permitting him to get thoroughly acquainted with the district under his charge, to cover it with valuation surveys and reproduction studies, and extend the knowledge of the different tree species. In this regard it may be interesting to note that at present the Bureau shows a classified list of 665 species indigenous to the soil, including approximately the most valuable woods of economic or commercial value. It is expected that eventually from 1,000 to 1,500 species will be secured.

In marking trees many things are to

NATIVE METHOD OF SKIDDING WITH CARIBAOS IN LUZON. A CHANCE FOR AMERICAN IMPROVEMENT.

SCALING RAFTED TIMBER NEAR MANILA. NOTE BAMBOO WITHES WHICH BIND THE LOGS.

be considered. If the rules of silviculture are followed, it is comparatively easy; but often, when a tree is found that should be felled, the licensee or his representative steps in and demurs. It is too large to be hauled out of the forest, too far from water, or a useless species, they say. To illustrate: Although there are in the writer's district over 250 species of trees, only a few of them are at present on the market. Hence it is incumbent upon the forester to prohibit the cutting of rare or valuable species and to retain their seed trees rather than to mark for felling everything which should from a silvicultural point of view be removed.

VALUATION SURVEYS.

The lack of competent men has made it necessary to stop the running of valuation surveys, and also to limit the time which should be spent upon studies of reproduction. Nevertheless, during the past year much stress has been laid upon valuation surveys and several parties charged with this work dispatched to different islands. As the nature of the work demands a continual moving from place to place, it is seldom possible to stay any length of time in one of the small villages. Camping out in the mountains requires a good equipment of tents, blankets, and last, but not least, provisions. When camp is near the sea, good fish and oysters can be obtained; but in the mountains one has to subsist entirely upon canned goods. There is, it is true, game in abundance—wild carabaos and pigs, also a variety of birds; but the members of the party are usually too fatigued to go hunting on Sunday, and the natives with their primitive methods are not successful sportsmen. During work in the mountains of Baler, Tayabas, it was necessary to move camp about every two weeks to avoid loss of time in going to and from the base of operations. Trails did not exist, and the party was compelled to return over the line of its surveys or through the rocky beds of rivers. In such cases progress was very slow.

The work itself was done in the usual way. A straight line was run without

reference to the nature of the country, and thirty-three feet on each side of the line all trees down to eight inches were calipered. At the same time notes were taken upon reproduction, soil, etc. The main difficulty was to find good men to do the calipering, as it is requisite for them to know the trees and be able to read the numbers. Frequently it was necessary to detail two men, one to read the numbers and the other to tell the tree species. Owing to this, and the dense undergrowth, an average of only five acres could be calipered in one day.

For several weeks the writer had Negritos for guides. These people belong to the non-christian tribes, live always in the mountains and seldom descend to the villages. They build no houses and seek shelter for the night under a few palms or banana leaves. They are reliable guides, and are acquainted with the native names of all that moves or has its being in their haunts, as well as with all trees and other plants.

Two men of the party measured the height of the more important species, and a young, well educated Filipino made a careful collection of all the trees which had either flower or fruit. In each case the tree was felled and a log six feet long was taken to be tested in the timber-testing laboratory of the Bureau at Manila; logs, leaves, flowers, etc., received the same number. Ninety-five different species were collected in this manner; another party, working in Camarines province under Forester Hagger, secured no less than one hundred and fifty-five different species of trees.

All cutting is done with the axe, a small wedge-shaped tool with a straight handle. Several efforts have been made to introduce the American axe, but so far without result. In Baler, where the natives work under American foremen, modern axes are used and also crosscut saws.

REPRODUCTION.

For reproduction studies the method described by Mr. Knechtel in No. 2 of the *Forestry Quarterly* is used. Squares of one-half an acre each are measured off and counts are made in squares eighteen feet on a side, two of these smaller squares being taken in each half acre. The trees are calipered down to

FILIPINOS SAWING TIMBER.

three inches and the reproduction is classified into four groups, viz: seedlings, saplings of one-fourth, one-half, and one inch. The variety of species is very great, as many as forty-four being found on one half-acre and thirty-nine on a square of eighteen feet. This refers wholly to trees, not counting the numerous bushes, vines, and palm-like plants.

No stem analysis and accretion studies have been made so far, as no method could be devised to do this work with any degree of accuracy. A good many of the Philippine woods, especially the hard ones, show no rings at all, and where rings are visible they are very indistinct and run together, and, what is yet more important, there seems to be no regularity as to the time which is necessary to form a ring. In young trees, the age of which could be exactly traced, we found more rings than the trees had years. This is due to the uniformity of the climate the year round.

Capt. George P. Ahern, Ninth U. S. Infantry, Chief of the Bureau of Forestry, is constantly seeking the betterment of the force and the extension of the service. In view of the fact that the Bureau passed under control of the Americans by G. O. Order No. 50, April 14, 1900, and reorganized under acts of the Philippine Commission bearing date of June and July, 1901, the amount of work accomplished has been remarkable. The revenues alone bear testimony to this. During 1900–1901, they were $199,373.00, in 1901–1902 they rose to $348,073.00, and in 1902–1903 they reached $527,414.00, or a grand total of 1,074,861 Mexican pesos.

There is in contemplation an experimental station near Manila, where studies of tree growth and their development can be made, a nursery for young plants maintained, and, possibly, a school for native rangers and assistant foresters established.

THE RECLAMATION SERVICE IN CALIFORNIA.

ITS ORGANIZATION, GENERAL SCOPE, AND METHODS OF PROCEDURE, WITH SHORT DESCRIPTIONS OF THE LEADING PROJECTS UNDER CONSIDERATION.

BY

J. B. LIPPINCOTT,

SUPERVISING ENGINEER FOR THE IRRIGATION WORK OF THE UNITED STATES GEOLOGICAL SURVEY IN CALIFORNIA AND FOR THE COLORADO RIVER.

THE main office of the Reclamation Service in California is located in the Byrne Building, in Los Angeles. A branch office has been opened at 431 Rialto Building, San Francisco; at Yuma, Arizona, and at Bishop, in Inyo county. The organization is entirely under the civil service, and the appointment of all the men has been by competitive examination.

Sacramento Valley.—Mr. H. E. Green, engineer, is in charge of the study of the drainage basin of the Sacramento Valley with a view to its development by irrigation. His headquarters are at the San Francisco office. From present information it is believed that during the spring and early summer sufficient water is normally found in the streams to provide for a very extensive system of irrigation. The Sacramento River, however, is a navigable stream, and it is not deemed wise to make extensive diversions therefrom during the low stage of the river or its tributaries in the middle and late summer months. The water to be supplied for irrigation during this low stage must be supplied from storage reservoirs to be located either on the main stream or on its tributaries. The investiga-

tions, therefore, in this drainage basin have been preliminary explorations for reservoir sites and the determination of the available water supply.

In this work particularly, and other work in general, the State of California is extensively coöperating with the U. S. Geological Survey in carrying out these investigations, the state paying a material portion of the field expenses, and the Geological Survey paying the salaries of the employés. The governor of the state is particularly active in his desire to assist in the development of this section by an exhaustive study of its resources, and by bringing the attention of both the nation and the local public to the latent opportunities.

In addition to the work of the Geological Survey, the forest cover of the mountainous portion of the basin is being studied by Mr. Gifford Pinchot, Forester of the Agricultural Department, and his assistants, with a view to preserving the forests and thus protecting the water supply. The Topographic Branch of the Geological Survey is also receiving assistance from the state and is concentrating its efforts in the preparation of a contour map of the irrigable lands of the Sacramento Valley. About six topographic parties are now in the field carrying out this work. They are making their maps on the scale of 2 inches to the mile, with 5-foot contour intervals.

Cache Creek.—Cache Creek is one of the large tributaries of the Sacramento, entering the valley from the Coast Range. This tributary was extensively studied for the Geological Survey by Mr. A. E. Chandler, the present state engineer of Nevada.

A very extensive opportunity for impounding water economically in Clear Lake has been found and the subject discussed in an irrigation and water supply paper entitled "Storage of Water on Cache Creek." Within the past year all of the water rights of Cache Creek have been concentrated under one holding by certain parties living in Woodland, their intention being to develop Clear Lake as a reservoir site for the irrigation of the lands of Yolo county. It is understood that the object of this concentration is the general development of the county.

The agents of the Geological Survey have held numerous conferences with these gentlemen with a view to having this work undertaken under the Reclamation Service. The Survey was inclined to make favorable recommendations to the Secretary of the Interior bearing on this subject, provided a favorable adjustment of water-right questions could be arrived at with these owners. After negotiations had been carried on for several months, assisted by the governor of the state, it was found impossible to reach a conclusion with the owners which could be recommended by the engineers of the government to the Secretary of the Interior. It was a matter of regret that this adjustment could not be accomplished, as it is believed natural opportunities of marked merit exist here, and the broadest development of these lands and prosperity of the community would be assured by this means.

The entire project hinges on the use of Clear Lake as a storage reservoir This body of water, covering 40,000 acres, has been declared as navigable by several acts of the California legislature, and it is a serious question whether it can be used legally without the consent of the government. It is not deemed advisable to legally contest this point at present. The California Water and Forest Association, as well as the Woodland Chamber of Commerce, coöperated with the Geological Survey in the investigation of Cache Creek.

Stony Creek.—Stony Creek is a western tributary of the Sacramento. In coöperation with the California Water and Forest Association, as well as with the Willows Chamber of Commerce, the Stony Creek basin was investigated by the Geological Survey; numerous reservoir sites were found thereon, and gaging stations established, the records on which are still being continued. A report on this drainage basin known as The Storage of Water on Stony Creek, California, has recently been issued by the Geological Survey.

Puta Creek, another tributary of the Sacramento, has been explored during

the past season; a reservoir site found thereon, and a gaging station established.

Upper Sacramento.—A general reconnaissance has been made of the upper basin of this river, and a number of reservoir sites of marked value have been found, notably at a point near Red Bluff and at Bieber. These great reservoir sites could be used in connection with the general program mentioned above for supplementing the available late summer water for irrigation in the Sacramento Valley. Other sites have also been found, particularly on the South Fork of Pitt River. Gaging stations have been established at all of these sites to determine their available water supply, and during the coming season detailed surveys will be made of them. In all, records of flow are being maintained at ten gaging stations in the valley of the Sacramento River, and the entire time of an engineer has been assigned to the maintenance of these records. These will be continued until a complete report is made outlining the general possibility of developing this great valley in a comprehensive way, and in such a manner as not to interfere with navigation.

It will be desirable in connection with this general study to investigate the overflow problem of the low valley lands and consider the subject as a whole. There is apparently a very small area of public land available for irrigation in the drainage basin of this stream, and the general development of the country will be dependent upon the organization and coöperation of a great number of individuals who are now land owners in this district. It is a matter worthy of note that both the National Irrigation Association and the Trans-Mississippi Congress, during the past season, have passed general resolutions favoring the construction of great public irrigation works on the Sacramento River. The undertaking will be vast. The province of the Geological Survey is to make a complete report to the Secretary of the Interior and the governor of California outlining the latent possibilities.

Probably no section of arid America has greater natural resources or has left them in a more undeveloped condition than the Sacramento Valley. Favored by geographic location, climatic conditions, soil, and water supply, this valley should be one of the densely populated districts of the United States, rivaling in wealth and prosperity the famous valley of the Po in northern Italy, which it so closely resembles.

Owens Valley.—Owens Valley is situated in a district that is sometimes called "undiscovered California." It lies on the eastern side of the Sierra Nevadas, in Inyo county, flanked by the most rugged and picturesque range of mountains on the continent, blessed with a copious water supply, but isolated because of imperfect transportation facilities. Mr. J. C. Clausen is the engineer assigned to the study of this district. Probably a large area of arid public land may be reclaimed here. All the remaining public lands in this locality have been withdrawn, subject to entry only under the Reclamation Act.

An extensive reservoir site has been found on the main river above Bishop, and this has been surveyed in detail during the past season. The irrigable lands are now being mapped and classified. The whole situation is dependent on the factor of the remaining available water supply. In order to determine this point the capacity of reservoirs must be found, the flow of the streams determined, and the present diversions of canals closely gaged. Mr. Ralph S. Hawley is devoting his entire time to these water measurements, maintaining eighteen gaging stations in the Owens Valley district. The people of this community are extremely anxious to have the government store the surplus flood-waters and regulate the stream flow, not only for the benefit of their lands, the supply of which is now somewhat irregular, but also for the extension of the irrigated areas. It is probable that a drainage system in connection with the general development will have to be constructed, as large areas of land in this valley have been ruined by the excessive use of water, and it is believed that the available acreage can be materially increased by their adequate drainage.

From discussions with railroad officials and the people of the valley, the conclusion is believed to be fair that with a general development of the valley by the federal government transportation facilities will be greatly improved and railroad connections established with the south, which is the natural outlet of the valley, connecting with southern California points. The work in the mountainous portion of the district has been discontinued owing to the winter season, but will be renewed in the early summer.

UPPER DRAINAGE BASIN OF KING'S RIVER.

King's River.—The U. S. Geological Survey has made extensive investigations of the drainage basin of King's River and the lands irrigated therefrom. A report has been published under the title "Storage of Water on King's River, by J. B. Lippincott." This report points out the possibilities of utilizing certain reservoir sites of large capacity on this stream for the regulation of the water supply and the extension of irrigated areas.

At the time this report was made all the canals on King's River associated themselves in an organization known as the King's River Storage Association. The platform on which they stood was to the effect that they had been spending about $40,000 a year in lawsuits over these waters, and they considered it more desirable to construct works to increase the water supply than to litigate over the natural flow. The great result which this association accomplished was to reach an amicable agreement among themselves for the proper division of this water. Schedules have been arranged which determine the division of waters under all varying vol-

umes for the different periods of the year. Litigation has practically ceased and good will prevails. Probably fifty lawsuits have been dismissed as a result of these agreements. This association joined forces with the Geological Survey for the examination of this district. At the request of the president of the association the engineers of the Reclamation Service went to Fresno, and, at an extended meeting with them, explained the operations of the Reclamation Service with a view of constructing these reservoirs as public works. The matter was thoroughly discussed at two conferences held at Fresno in November.

The flow of King's River is peculiarly adapted to the needs of this district, or inversely such crops and agriculture have been developed in this locality as best suit the flow of the stream. In other words, the vineyards, if supplied with a copious volume of water in the spring and summer, when the river is normally at its flood flow, are able to produce satisfactory crops without further irrigation in middle and late summer. The dairy industry, however, which is now beginning to be developed in this region, requires a continuous water supply. The operations of the reclamation law were fully explained to the officers of the King's River Storage Association, representing some twelve or fourteen canal companies, and it remains largely with them to say whether the construction of these reservoirs under the federal law shall be undertaken. The sentiment expressed at the meeting was rather unfavorable to the procedure because of the expense involved and because of the general satisfaction with present conditions.

Since the investigation of 1900 nearly all the canals diverting water from King's River have increased their capacities, and it will be necessary for them to make some concessions of water from the spring and early summer flow, and also from the midwinter flow, in order to adequately supply the reservoirs considered. This water would be available for use in late summer. The flood water that could be saved and augmented by the present supply used for irrigation would be the floods of February and March and a portion of the highest water of April, May, and June. The policy of the department prohibits any effort at the promotion of irrigation enterprises on a community, and they will not act as advocates in this or any other situation for the construction of public works.

Salinas.—The drainage basin of the Salinas River was investigated by Mr. Homer Hamlin, engineer, United States Geological Survey. An elaborate report has been prepared and is now in the press. It shows the possibility of developing the Salinas Valley by impounding a reservoir on the Arroyo Seco. Plans and estimates are given in detail, irrigable lands are shown, and a map presented showing the depth to ground water and the possibility of obtaining the water supply by pumping therefrom.

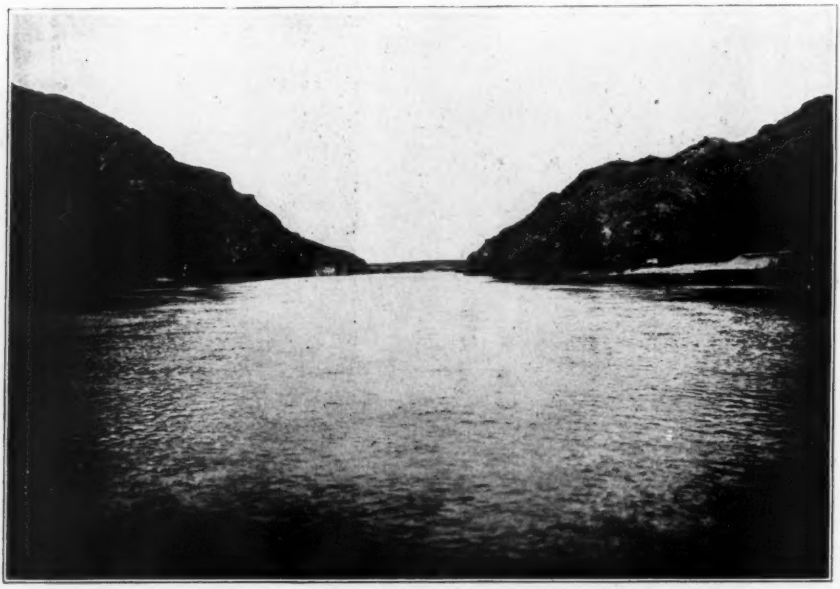
Santa Barbara.—One of the most delightful districts in the State of California is the narrow coastal plain near Santa Barbara. Unfortunately, this district does not have an adequate water supply from local drainage basins. The U. S. Geological Survey, coöperating with the city of Santa Barbara, has prepared a series of topographic maps covering all the lands on either side of the mountain range, and particularly in the drainage basin of the Santa Ynez River. Following this topographic survey, explorations were made for reservoir sites in the basin of the Santa Ynez. The Santa Ynez River flows in a northerly direction, but on the eastern side of the Santa Ynez range of mountains it is separated from Santa Barbara by this range.

The stream flow is of a very spasmodic or erratic nature, passing off in great flood waters almost entirely in the mid-winter season, and in the summer season dry throughout the greater portion of its course. These storage reservoirs, if built, would catch these winter floods and hold them for summer use. The reservoirs were surveyed, stream records have been kept, and following these the city has located a tunnel line from a point below the reservoir sites on the river to a point on the south side of the range. While it is proposed that the city construct this tunnel, it is their

KING'S RIVER A SHORT DISTANCE FROM THE MOUNTAINS WHERE IT RISES. LOOKING UPSTREAM.

policy to permit it to be used by others who may construct reservoir sites in this mountainous drainage basin. The tunnel will be 4 miles in length between portals. The interests of the city consist, not only in obtaining an adequate water supply for domestic purposes, but in assisting the general development of suburban property.

As a result of the investigations by the Geological Survey, a bond election has been held in Santa Barbara and funds have been voted, almost unanimously, for the construction of the tunnel line. The building of reservoirs will probably follow. Full details of the investigations are now being printed in a water-supply paper entitled Storage of Water in Santa Barbara County, California.



DAM SITE ON THE LOWER COLORADO. TWO MILES BELOW NEEDLES BRIDGE.

Colorado River.—During the winter season practically all the work of the Geological Survey for the California Division in the Southwest is being concentrated along the Colorado River. It is in charge of Mr. E. T. Perkins, engineer. A general topographic map in 10-foot contours of all the lands between the mouth of the Grand Canyon and the Mexican line will be finished soon. This map will show all reservoir sites as well as all the irrigable lands, and is the basis for a comprehensive and exact study of the irrigation situation along this stream.

The Topographic Division of the Geological Survey, in coöperation with the Imperial Company, is to make a topographic map of the entire irrigable district from Inyo south to the Mexican line and east to the Colorado River. This will be a very satisfactory basis upon which to study a general distribution system.

Detailed investigations are now going on upon which will be based plans and estimates of a project to irrigate the lands both in California and Arizona, above and below Yuma, all of which data are to be submitted to the Secretary of the Interior for his consideration. Two diamond core drilling outfits are at work on the river above Yuma, prospecting for bed rock upon which to found diversion structures. Definite canal locations are being made, both on the California and Arizona side, upon

which estimates of cost will be based. Probably 100 men in all are engaged in these engineering parties, and it is hoped that this work will be so far advanced that a definite report may be made during the coming summer. The Yuma Indian Reservation on the California side, under existing laws, may be thrown open to entry when the lands are irrigated, and allotments of five acres made to Indians now residing thereon. On the Arizona side there is a considerable area of public land that can be reclaimed, and a large amount which is now either entirely arid or partially irrigated in private holdings can be benefited.

The engineering problems on the Colorado River are difficult and probably among the most complex that will be encountered in the arid region. There is no reason for believing, however, that they cannot be favorably solved and works constructed that will give satisfactory results. Probably the greatest opportunities in the Southwest for very extensive irrigation development lie along this great stream. The volume of the available water supply, the area of the irrigable lands, the fertility of the soil, and the character of the climate, all point to a very great development. The district would be tributary in trade to the towns of southern California and is believed to offer probably the greatest latent resource back of the coast district. Reservoir sites of large capacity have been found in the upper portions of this stream to supplement the low stages of the river, which fortunately occur in mid-winter. The locality, however, is what may be termed a "twelve-months country"—one that can be farmed continuously throughout the year.

THE SOUTH PART OF PIKE'S PEAK FOREST RESERVE.

INTERESTING NOTES ON FIRE CONDITIONS, WATER CONSERVATION AND MOUNTAIN TIMBER IN COLORADO.

BY

JACOB C. BLUMER,

BUREAU OF FORESTRY.

THAT part of the Pike's Peak Forest Reserve lying south of the Manitou and Pike's Peak Railroad, or "Cog Road," embraces seventy-nine square miles of the Rampart Range of the Rockies in central Colorado.

This tract extends through fully 7,000 feet of altitude. The vast, shadowy heights that form it rise abruptly out of a great plain that lies at 6,500 feet above sea-level, and culminate at 14,147 feet in Pike's Peak itself. All but a half dozen square miles in the southwest portion, which approach an undulating plateau, is either extremely rugged, or steeply sloping in every direction, save a few "parks" or mountain meadows.

The geologic feature is a coarse, pink, rapidly disintegrating granite. Hardly another formation occurs except in the irregularly projecting southeast arm of the reserve, where a hard, gray granite, occasionally mixed with massive quartz, predominates.

The paucity of the flora is noticeable, and yet the number of species on this comparatively small tract is surprisingly large. The paradox explains itself when one bears in mind the great variety of altitudes, slopes, and aspects which occur, each with a climate of its own.

The Cripple Creek gold-mining district, with its 35,000 people, begins about five miles away in the mountains to the

Illustrations, including frontispiece, through courtesy of the Bureau of Forestry, U. S. Department of Agriculture.

west; Colorado Springs, Colorado City, and Manitou, with nearly as many, lie eastward just under the mountains; and Pueblo, supporting as many more, some thirty-five miles south on the plain. The Short Line Railroad (which cost $80,000 per mile) connects Colorado Springs with Cripple Creek, winding over the east and south parts of the region. Many thousand tourists view the scenery from its trains every summer. The "Cog Road," running one to six or more of its unique trains daily during the season, unites Manitou with the summit of Pike's Peak. Several wagon roads lead over the more approachable parts of the tract. One of these, called the "Circle Drive," was constructed at considerable cost by Gen. William J. Palmer during the past summer, and opened to the public. Burro trails follow many of the mountain streams, giving rest and refreshment to the jaded health-seeker from the hot and dusty thoroughfares of the city. The prospector, in search of gold, penetrates every cove and gulch, and truly leaves no stone unturned. Numerous shafts and tunnels have been sunk, but no pay ore has been shipped as yet.

Perhaps the most refreshing fact that appeals to the visitor upon arriving at Colorado Springs is the abundance of clear, cool, mountain water that flows from the street-corner fountains. At great cost the city secured this priceless boon of nature by an extensive system of pipe lines, tunnels and reservoirs, chief among the latter being Lake Moraine, between Pike's Peak and Mt. Baldy. The per capita water consumption, some 300 gallons daily, is said to be the largest of any city in the United States.* The supply becoming inadequate, the city is now building two large new reservoirs at Seven Lakes and boring a half-mile tunnel as an outlet.

On the west slope of Pike's Peak, at timber line, lies a reservoir that waters the city of Victor, in the Cripple Creek district. At the southwest corner of the reserve is the large reservoir of the Woods Investment Co., valued both for the water itself and as a source of power for the ore mills and factories of Pueblo and the Cripple Creek district. The aggregate capacity of the present reservoirs within the tract is nearly one billion gallons.

Grazing is allowed to 2,000 head of cattle inside the reserve lines. Since they forage only on the "parks," no harm is done to the forest. They will need to be held within bounds, however, to save the sources of water supply from pollution.

There is a current impression that, between the wildcat saw-mill and the fire, the remnants of the Colorado forests are of late years fast disappearing. However truly this may apply to other parts of the state, it is not true on the south part of the Pike's Peak Reserve. Here the forest conditions are greatly improved from those of forty years ago. The bulk of the forest disappeared with the advent of the white man at the middle of the last century. About 1848–1850 a conflagration, or series of them, of gigantic magnitude swept almost every height and canyon of these mountains. Collected data prove this fact beyond a doubt. Fully 75 per cent of the area was devastated. Folk-lore has it that the Indian upon the approach of the whites set fire in order to drive out the game and keep it from falling to the latter's thieving shots. Ruxton, an English traveler who visited these parts in 1846, speaks in his diary of forest-covered mountains.

Since 1850 the fires have been few and small in comparison, partly because of the lack of fuel. Following the Cripple Creek gold discovery in 1892, much young growth was burned along the newly opened gold-seeker's trail. The latest fire occurred last August, on the slope of Big Chief, sixty acres of virgin or old timber being destroyed. There is at present one ranger to patrol the entire seventy-nine square miles of mountains. This is entirely insufficient. Moreover, the largest two tracts of timber yet remaining are practically inaccessible. This fact has saved them.

The decreasing water supply had much to do with the awakening of the people to the status of their forests. In July last this active interest resulted in the formation of the Colorado Springs Forestry Association.

* See frontispiece.

MOUNT ROSA AS SEEN FROM THE "SHORT LINE."

EFFECT OF FIRE IN THE MIDDLE BEAVER VALLEY ONE-HALF MILE BELOW SEVEN LAKES. ALTITUDE 10,700 FEET.

The U. S. Weather Station at Lake Moraine records no decrease in precipitation for the past ten years. This being true, the yield of water must be increased or at least more evenly distributed throughout the year on account of the improved forest conditions. Therefore the cause of the water shortage must rather be sought in the multiplied consumption of the growing industries and population.

The longest straight line which could be drawn in virgin timber still remaining is hardly a mile in length. The major portion is scattered in smaller parcels, excepting certain areas in the western and southern parts of the tract, which are practically denuded. Rather less than nineteen square miles is still covered thus with virgin forest. To this may be added six square miles of young growth thick enough to replace the original stand, making a total of twenty-five square miles, or thirty-one per cent, that may be called forested. More or less reproduction exists wherever the great fire scourge left a crippled tree to bequeath its legacy of seed to Mother Earth before it died. The area thus occupied embraces some twenty-eight square miles.

After deducting three-and-one-half square miles for land above timber line, an equal area for "parks," lakes and reservoirs, and one square mile for talus slope covered with loose gravel or rock, there remains an area of eighteen square miles, or nearly twenty-three per cent, without any forest growth whatever except the ubiquitous aspen. This area, and especially those portions of it which at higher altitudes partly cover the sources of the different water systems, needs afforesting attention. However, the greater part of such work here, as elsewhere on the tract, must be left to Nature. The one paramount part that man must play is—*keep out fire.*

The aspen exists abundantly in all altitudes and aspects of denuded land to timber line; yet some areas form curious exceptions. It is of various ages up to fifty years, but almost never older. Only in a few instances does it fulfill the office of nurse to the conifer much younger than itself. The case is conspicuous by its general absence. Not only is this true far from seed-trees, but on seemingly favorable sites among trees that have borne cones at least ten years ago. The Engelmann spruce, under best conditions, bears its first cones at about twenty-five years of age, while twenty years approximates for limber pine. Why no reproduction takes place is one of the problems to be solved.

The reproduction of Engelmann spruce is practically even-aged. The overwhelming number are from thirty-five to forty-five years old. Limber pine and red fir both predominate at twenty-five to thirty, coming in after the fire more tardily as well as more persistently. These three form the bulk of the young generation, with the Engelmann spruce far in the lead.

A striking feature of these high woodlands is the great amount of dead timber standing and lying among the living. It is not unusual to see every third one of the standing trees dead. The novice concludes that the forest is dying by some unknown pest. The investigator finds that these trees have long been dead, and are preserved intact like the mummies of Egypt. The great preservative is the dry, cool rarity of the Rocky Mountain air, which is death to the organisms of decay. Timber killed by the fire half a century past is to-day sold at Colorado Springs at $4.50 per cord. For mine timbers it is preferred to green wood. To lessen the fire danger, it should be removed wherever there is much young growth.

The eleven cone-bearing species that follow are mentioned inversely to the order of their relative abundance, which probably coincides with the order of importance viewed from the standpoint of water conservation.

Only four or five specimens of lodgepole pine (*Pinus murrayana*) were discovered in as many months of observation by several men. A few red juniper (*Juniperus scopulorum*) occur along the south boundary of the reserve, in the valley of Little Fountain Creek. In the same locality is found a considerable sprinkling of the bushlike pinyon (*Pinus edulis*). Isolated seedlings were seen elsewhere as high as 9,700 feet.

Jack* reports it in but one place within the reserve—that is, William's Canyon, near Manitou, at 8,000 feet. A small number of blue spruce (*Picea parryana*) find a habitation below 8,500 feet in the sunny swales of the southwest portion of the reserve and on Little Fountain Creek. The alpine fir (*Abies lasiocarpa*) is curiously restricted to one or two square miles between 10,000 and 11,000 feet on north slopes in the upper North Cheyenne Basin. Few old and many young trees seem to indicate that the remainder being red fir. It holds its own in the reproduction of burned areas, and, like its congener just preceding, is the first to spring up after fire.

The bristle-cone (*Pinus aristata*), also called range pine and foxtail pine, is a tree of habitual decrepitude. It finds foothold on many dry, exposed westerly slopes down to 9,000 feet or less, as well as at highest forest altitudes up to 12,000 feet, where it clings to the inhospitable rocks in grotesque forms and defies the arctic storms. While it has borne cones

TALUS SLOPE AT 11,500 FEET. SHOWING SCRUBBY RANGE PINE AND ENGELMANN SPRUCE.

it is an adventive species. It was first to spring up after the fire, preceding the Engelmann spruce by about five years. As high as 5 per cent occurs in mixture with a dense stand of the latter.

The white fir (*Abies concolor*), locally known as balsam, is limited to parts below 9,000 feet, and here mainly to the southeast arm of the reserve. It has been observed in pure stand and forms more than half of some virgin slopes, quite generally, often for three successive seasons on the same tree, it shows the smallest relative number of seedlings. These are found only near mountain tops and on exposed high ridges. The wood is not readily accessible, but has high fuel value. Because of larger pitch content, this value increases with higher altitude. The fire-killed timber was formerly much used in making charcoal for the smelters. One ton of wood yielded 100 bushels of charcoal, worth 11 cents per bushel.

*Jno. G. Jack: Part V, 20th Annual Report, U. S. Geological Survey.

The two trees that occupy by far the largest share of the land under 9,000 feet altitude are the rock pine (*Pinus ponderosa scopulorum*, also known as bull pine or yellow pine) and red fir (*Pseudotsuga taxifolia*).

They are almost coextensive in distribution, yet seldom occur in mixture. While the first, in its usual open habit, covers the southerly slopes and more level country, the latter, in much denser stand, takes to the steeper, cooler slopes. It makes the most abundant and generally distributed young growth below 9,000 feet. The pine also reproduces readily where chance is given. It is a good fuel wood and yields some clear lumber. The red fir is locally known as red spruce and esteemed the best timber of the region. It is much sought for lumber, mine timber, ties, poles, and piles.

The tree which eventually will thickly dot even the barest southerly slopes between 9,000 and 11,000 feet is the limber pine (*Pinus flexilis*), natively called white pine; but the process is extremely slow. In the situations mentioned a few bodies of timber composed mainly of this tree are left, yielding many ties and mine timbers, and some saw-timber. It usually makes a fairly straight log twelve to sixteen feet clear. Its fuel value ranks close to that of bristle-cone pine. Owing to its rather dry, sunny habitat, it ranks as a water-conserver probably no higher than red fir.

To the Engelmann spruce (*Picea Engelmanni*), locally known as white spruce, easily belongs the preëminence as a water-conserver of these mountains. Following the streams of the canyons as far down as 7,000 feet, it covers in more or less pure stands most of the northerly slopes from 9,000 to 11,500 feet, and finds its ideal realm in the frigid shadows just below the timber line. Commercially it is as yet of no great moment, owing to difficulty of access as well as knotty and often twisted bole. Nevertheless, some lumber has been sawn from it, and the tree may become valuable as pulp wood. It is ordinarily of very slow growth, but varies in dimensions between great extremes. A tree half a hundred years old may be one foot or fifty feet in height. Ten years under favorable conditions will suffice to grow good-sized catalpa poles. Some pole stands of Engelmann spruce of similar size occur that have taken 250 years to grow. Eight thousand forty-year-old trees have been counted upon one acre. It is this unusual and persistent density, together with the shady slopes at high altitudes, that preserve the snow for eight to nine months of each year, feeding the streams as they need it the water of life for the thirsty fields and multitudes below.

RECLAMATION OF ALKALI LANDS IN UTAH AND CALIFORNIA.

COMPILED FROM CIRCULARS Nos. 11 AND 12 OF THE BUREAU OF SOILS, U. S. DEPARTMENT OF AGRICULTURE.

BY

THOMAS H. MEANS AND W. H. HEILEMAN.

A Demonstration Near Salt Lake City, Utah, in Coöperation with the Utah Agricultural Experiment Station:

In 1899 a party from the Bureau of Soils made a soil survey of that portion of the Salt Lake Valley lying west of the Jordan River. In this report full consideration was given to the question of the alkali soils around Salt Lake City, the cause of their formation, their character and present extent, and the means of their amelioration and reclamation. The following paragraphs are taken from this report:

"On the west side of the Jordan River the earliest attempts at irrigation were on the Jordan meadows, or river bottom lands, the water supply being obtained from the Jordan River by means of small canals. Subsequently the Brighton and North Point and the North Jordan canals were run upon the first terrace above the river, and following these were the South Jordan and the Utah and Salt Lake canals on the second and third benches, respectively.

"As is frequently the case, the irrigation on the benches caused an accumulation of seepage and alkali on the river bottom land, so that much of it has been abandoned. The largest and most seriously damaged area, however, is just south of Twelfth Street road, and comprises a strip of land varying from half a mile to a mile and a half in width, and extending 10 miles west from the river. Here the seepage and surplus waters from the outer extremities of the Utah and Salt Lake, the South Jordan, and the North Jordan canals have collected to an alarming extent. Indeed, the damage has gone so far that a chain of lakes has formed, presenting a water surface of fully 1,000 acres. The area affected is not less than 10 square miles.

* * * * * * *

"The seepage and waste waters from the canals account in great measure for the 10 square miles of good land which has already been ruined by seepage and alkali. It has been shown that the water is of good quality, and the lands of the upper benches are naturally free from any great excess of alkali; but the continual seepage from the canals during the growing season for a great many years has transported a quantity of salt to the lower levels.

"The application of water on the lowlands west of Salt Lake City, where there is a large amount of alkali in the lower depths, has been attended with very disastrous results to crops. The salt has quickly risen to the surface and, even where the surface foot was originally free from alkali, the crops have been completely ruined in the course of two or three years."

In order to bring a matter of so much importance to the attention of the farmers and the community at large, an experiment to demonstrate the value of drainage in alkali reclamation was planned. In the carrying out of the work the Utah Experiment Station entered into coöperation with the Bureau of Soils, and in 1902 a tract of 40 acres, belonging to Mr. E. D. Swan, was selected for the demonstration. This tract lies 4 miles west of Salt Lake City, about half way between the two railroads running directly west from Salt Lake City to Salt Air and to Garfield Beach. The nearest railroad station is Buenavista, distant one-fourth of a mile from the tract, on the San Pedro, Los Angeles and Salt Lake Railway.

The land, at the time work was commenced, was all strongly impregnated with alkali salts, and had nothing growing upon it except a few alkali weeds, the most prominent of which was greasewood. The land was considered valueless by the farmers of the neighborhood.

The tract lies on the east side of Williams Lake, and at its highest point has an elevation of about 8 feet above the part of the lake bed adjacent to the tract. The sketch map shows the plan of the tract and the size, depth, and distance apart of the draintile installed.

The cost of this installation was as follows:

270 ft. 10-in. tile, at $100 per M ft.	$27 00
300 ft. 8-in. tile, at $64 per M ft.	19 20
520 ft. 6-in. tile, at $27.50 per M ft.	14 30
6,580 ft. 4-in. tile, at $17 per M ft.	111 86
2,890 ft. 3-in. tile, at $13 per M ft.	37 57
Fittings	2 80
Freight on 3 carloads, Ogden to Buenavista	60 00
Cartage and scattering tile	17 50
606 rods ditch, at 50 cents per rod	303 00
67 rods main ditch, at 54 cents per rod	36 30
673 rods covering with team	19 50
150 feet outlet ditch (open)	6 00
One-fifth cost of tools	5 00
Total cost	$660 03

The average cost of the drainage system completed was $16.50 per acre, and it is believed that the drainage of larger tracts could be accomplished at about the same cost. Some of the stated items of expense could be considerably reduced, but others would be greater. For example, while it might be possible

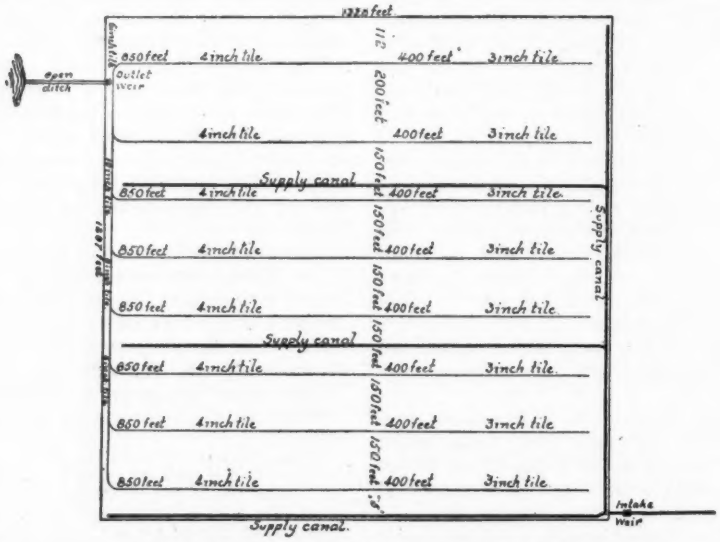
to obtain better prices on tile, if purchased in larger lots, the drainage of any more extensive area would require the digging of an outlet either to the Jordan River or to Great Salt Lake.

The tract is composed of a surface soil of loam and sandy loam, with a depth ranging from 12 to 18 inches. The underlying material is a heavy clay. A very shallow sand stratum occurs at a depth of 4 feet over the greater part of the tract. The lower or lakeward half of the tract is underlain at an average depth of 26 inches by white calcareous hardpan from 1 to 2 inches in thickness. Occasionally two strata of this hardpan are found, the first lying about 4 inches above the second.

Another special soil feature occurs in places in the tract. This consists of a layer of peculiar brown material, somewhat inclined to fracture along lines after the manner of adobe, and yet maintaining in the interior part of the layer a hard, impervious core. This material is found at from 4 to 12 inches beneath the surface. When it is turned with the plow in a dry condition, it breaks into particles ranging in size from inch cubes to granules about as large as buckshot. When wet, it still breaks on regular lines of fracture, but materially softens, and if thoroughly plowed loses its hardpan properties. In excavating during the drainage installation it was necessary to break the dry material with a pick, as was also the case with the white hardpan.

With the above soil and hardpan conditions it was deemed advisable to place the drains 150 feet apart, and this interval was used except in one instance. The system for the 40 acres includes eight lateral drains and one main drain. Each of the laterals is 1,250 feet long, and is laid with 850 feet of 4-inch and 400 feet of 3-inch drain tile. The exception already referred to is in the interval for lateral No. 8, which is laid 200 feet from the nearest lateral, the object being to study its efficiency under such conditions of soil as exist in this tract.

The main drain is put in across the lower part of the tract, 20 feet from its west side, and is met by seven of the laterals. This drain was laid with 270 feet of 10-inch, 300 feet of 8-inch, and 520 feet of 6-inch tile.



PLAN OF OPERATIONS NEAR SALT LAKE CITY.

Diagram used by permission of the Bureau of Soils.

The 10-inch tile in the main drain have a capacity sufficient to remove 4 inches of water per week from the adjacent lands, or lands underlain by laterals Nos. 1 to 7. Ordinary operations for reclamation do not overload the drains, however, since the factors of summer evaporation and subdrainage through the soil play important parts in the disposal of the water added in flooding operations.

Over the great part of the tract the drains were laid at a depth of 4 feet. In that part nearer the lake a somewhat shallower depth was necessitated in order to obtain a gravity outlet for the drainage water. The drains were laid on a grade of not less than one-tenth foot in 100 feet, except where 3-inch tile was used when the grade was somewhat higher. The illustration (Fig. 1), is a plan of the completed system, and shows the supply canals, position of the weirs, drains, and the position and extent of the different sizes of tiles. The system as installed has proven adequate. Flooding has been carried on systematically, the land being divided into checks and plats by levees, and each plat treated in rotation. During each flooding water has been added to an average depth of 4 inches. The movement of the water into the soil has been regular, and, considering the character of the clay subsoil, rapid, and the drains have quickly filled after the floodings and have run freely throughout the experiment.

During the last season (1903) the land was flooded once each week, with occasional longer intervals when the supply canal was being repaired or during times when the land was being plowed or the levees repaired.

Before any water was applied to the tract a detailed survey was made to determine the alkali content of the soil. This initial survey was made in September, 1902. The land was then flooded once and allowed to remain until the next spring.

In May, 1903, before work was commenced, a second survey was made, and a third survey of the tract was made in October, 1903, after the close of the season's operations.

The following table gives the tonnage of alkali in the tract, as shown by these surveys:

	September, 1902.		May, 1903.			October, 1903.		
	Alkali in 40 acres.	Per cent of total.	Alkali in 40 acres.	Per cent of total.	Per cent lost. *a*	Alkali in 40 acres.	Per cent of total.	Per cent lost. *a*
	Tons.		*Tons.*			*Tons.*		
In first foot.....	1,363	20	499	14	63	101	8	92
In second foot..	1,540	23	650	19	58	183	15	88
In third foot....	1,766	27	1,066	31	40	330	28	82
In fourth foot...	1,982	30	1,265	36	36	607	49	69
Total.....	6,651	.....	3,480	... ...	49	1,221	.....	82

a Shows the proportion of the salts removed as compared with the salt originally present in the various depths.

The data given in the above table shows that between September, 1902, and the following May, 3,171 tons of salt had been removed from the soil to a depth of 4 feet, and that between September, 1902, and the following October, 5,430 tons had been removed, or 82 per cent of the alkali originally in the first 4 feet of soil. It is also seen that a greater proportion of the alkali has been washed out of the surface foot than out of the lower depths, and that the movement of the salts is less pronounced as the depth increases. Thus originally the fourth foot carried 30 per cent of the total salt, while in October, 1903, the fourth foot carried 49 per cent of the salt then remaining in the soil. There has been, however, a marked decrease in the quantity of salt at all the depths, and the fourth foot has in reality lost 69 per cent of the quantity of alkali originally present.

It must be understood that these changes have taken place through the movement of the salts downward by percolating water and not through washing them from the surface of the land.

The following table shows the volume of water added to the tract from September, 1902, until October, 1903. The table shows also the volume of drainage over the outlet weir, and the salts (alkali) removed from the tract in the drainage water. The results are obtained from continuous measurements and daily collections of water samples for the entire period.

Month.	Volume of water added to tract.	Volume of drainage water from tract.	Salts in drainage water.
	Cubic feet.	*Cubic feet.*	*Pounds.*
1902—September	284,400	158,700	152,200
October	940,000	265,000	195,100
November	*a*171,300	251,000	353,800
December	*a*166,500	139,700	187,800
1903—January	*a*291,800	257,300	391,200
February	*a*136,400	174,400	214,800
March	*a*132,000	428,000	590,700
April	*a*112,000	26,900	26,500
May	*a*576,900	521,500	567,100
	760,900		
June	*a*106,000	274,500	345,200
	676,500		
July	*a*36,580	480,490	556,459
	1,691,970		
August	2,122,160	814,890	1,221,742
September	2,352,920	1,195,976	1,654,115
October	351,290	663,420	840,981
Total	10,909,620	5,651,776	7,297,697

a Fell as rain or snow.

Total volume of canal water used...cubic feet..	9,180,140
Volume falling as rain and snow.....do.....	1,729,480
Total volume from above sources..do.....	10,909,620
Total water used.....acre feet..	250.4
Salts added in the canal water.....pounds..	900,000

The total volume of drainage was 5,651,776 cubic feet, or 51.8 per cent of the water added to the tract. This 51.8 per cent drainage water carried 3,648 tons of salts over the outlet weir. The remainder of the salts removed from the tract have passed into the deeper subsoil and been carried away by the natural subdrainage.

The results so far obtained indicate the ultimate complete reclamation of the land. The single season's operations produced marked improvement in the land, not only in the alkali content, as shown by the soil tests made, or as shown by the salts in the drainage, but also as shown in the improved tilth of the soil and favorable changes that have taken place in its physical properties.

The indications are that the greater part of the tract is at present sufficiently sweetened to allow the growing of shallow-rooted crops. It is the intention to continue the work until reclamation is complete, and the data pertaining to the process of flooding and drainage will be supplemented by practical crop tests during the season of 1904.

A DEMONSTRATION AT FRESNO, CALIFORNIA.

At the time of settlement of the country south of Fresno, there was little indication of the presence of alkali in the soil, and no one then suspected that serious damage would result from irrigation. When, after a few years, alkali commenced to show in the vineyards and orchards the attention of thoughtful men was directed toward remedying the evil, but up to the time of undertaking this experiment nothing effective had been accomplished.

In 1900 the region was studied by the Bureau of Soils, and recommended drainage with frequent cultivation and copious irrigation as the solution of the problem.

It was decided to bring the value of drainage in reclamation work before the people by actually reclaiming some of this land.

A 20-acre tract was selected, belonging to S. M. Toft and N. H. Hansen, situated on Fig and Central avenues, about 2½ miles south of Fresno, and the work was undertaken in coöperation with these gentlemen.

The northern part of the tract had been settled upon by Mr. Toft in 1876, and at that time showed no sign of alkali. In 1899 Mr. Toft bought an additional 20 acres, at $350 an acre, the average value of land in the vicinity at the time. The southern part of the tract was occupied in 1862 by Mr. Hansen, and at that time was partially alkaline. It has never produced good crops. In 1890 alkali commenced to show on the northern part, and in 1898 and 1899 it was practically abandoned.

The tract lies in a level district where it was impossible to obtain a gravity outlet for the drainage water, except by digging a drain 2 miles long, so in order to raise the drainage water to the surface of the ground a chain pump operated by a water wheel was installed on Central Canal, where it crosses Fig avenue. A drainage system of this kind is admittedly not so desirable as one in which a gravity outlet can be maintained.

Three-inch, 4-inch, and 6-inch tile were laid over the tract at an average depth of a little over 3 feet and 150 feet apart. The original intention was to use nothing smaller than 4-inch tile, but the makers were unable to supply enough

tile of this size, so the deficiency was made up by using 3-inch tile. It was found impossible to lay the tile during the summer season, owing to the nearness of the water table to the surface and the resulting condition of the subsoil, which was too soft to permit the digging of a deep ditch. The work of ditching was commenced in December, 1902, and was completed in February, 1903. The cost of ditching, tiling, and all incidentals except the cost of pump and water wheel amounted to $16.50 per acre. The contract for the tile delivered in Fresno was for 3-inch tile, $24 per thousand, for 4-inch tile, $32 per thousand, and for 6-inch tile, $72 per thousand.

At the time of the installation of the drains 18 acres of the land contained too much alkali to produce a crop. Scattered over a part of the tract were small patches of alfalfa and an occasional fruit tree—remnants of former cultivation. About the 1st of March, 1903, irrigation was commenced. The land was divided into 30 checks, the size of each check depending upon the slope of the land. The largest checks, those on the level land, are about 2 acres in extent, while on the steeper slopes they are less than half an acre. The object was to divide the land in such a way that it could all be kept under water to a depth of 4 inches, and the reclamation was to be accomplished by maintaining the water at this depth until enough alkali had been washed out of the soil through the drains to enable the crop to be grown.

During the progress of flooding many difficulties were met, among them that of keeping the tiles from partially filling with sand and silt. Precaution was taken in laying the tile to put them in so the joints would be close, hay was thrown over the tile in the ditch before covering with earth, and a ridge of earth was thrown up to prevent the water from standing directly over the drains. In spite of these precautions the soil, which is very light, was so easily moved by water that it seemed to enter the joints almost as readily as did the water. This resulted in some of the drains becoming clogged, and it was necessary to relay a portion of the tile. After the land had been once thoroughly soaked and had settled, no difficulty was experienced from filling of the drains, and it is hoped that there will be no further trouble from this source. Most of the trouble was with the 3-inch tile, which is admittedly too small for use in soils of the light and silty character of the Toft-Hansen field. It is thought that there will be more or less silting up of the tiles whenever they are used in the sandy and white ash soils of the Fresno district, and it is recommended that every possible precaution be taken in putting them in. Much of the trouble may be obviated by using no tile smaller than 4 inches, or preferably 6 inches in diameter, and by giving the laterals such fall that the velocity of the water will be great enough to wash out the sand as rapidly as it enters the joints. The tile on the Toft-Hansen tract have a fall of 1 in 1,000, and the velocity of the water flowing through them is not sufficient to remove the sand. With a fall of 1 in 500, the velocity is great enough to remove practically all of the soil as fast as it enters.

To prevent entirely the clogging of the tile with sand and to insure the removal of roots should any chance to enter, it is thought advisable to place in all tile a quarter-inch galvanized strand-wire rope. Then two or three times a year, or oftener if necessary, a wire brush should be dragged through the tile in order to cut out all roots and stir up the sand and silt. Wire rope of this kind can be bought for about 1 cent a foot. Six-inch and 8-inch drains have been in operation for twelve years in the Sunnyside vineyard, and have been kept in perfect order in this way.

On July 15, 1903, after four and a half months of irrigation, an examination was made of the tract to determine what percentage of the land was sufficiently sweetened to grow a crop. This examination indicates that all of the land, with the exception of small spots amounting in the aggregate to less than 2 acres, is now ready for a crop. Most of it is sufficiently freed from alkali to warrant the sowing of alfalfa, but as

midsummer is not the best time of year for seeding that crop, sorghum and Egyptian clover are being put in instead. These crops will mature by fall if the supply of irrigation water does not fail, and in the winter the land will be seeded to alfalfa. The small spots which are not yet ready for alfalfa are rapidly approaching that condition, and will be ready for a crop during the coming winter. Thus it will be seen that practically all the land in this 20-acre tract has been returned to a state of profitable cultivation in a period of four and a half months after irrigation was commenced, and the statement seems justified that any alkali land in the Fresno district can be brought into profitable cultivation in less than one year's time, the two requisites for this being underdrainage and a copious supply of water for irrigation. While the soil experts consider the land of the Toft-Hansen field practically reclaimed at the present time, the demonstration will be continued until a satisfactory stand of alfalfa is secured.

The reclamation work on this tract has progressed so far that the most skeptical must be convinced that drainage and irrigation will reclaim alkali lands. A district of nearly 26,000 acres is now suffering more or less from alkali and seepage water, and it rests with the owners of this land to form a drainage district under the act passed by the last legislature of California, approved March 20, 1903. The formation of such a district will allow the construction of a drainage system which will result in the reclamation of all lands now alkaline and the prevention of further damage from this source.

The system recommended, after over three years' study of the conditions, consists of tile drains varying in size from 4 inches to 24 inches. The main drain will be an open ditch, collecting the water from the parallel tile drains one-half mile apart. This main will deliver the water at the surface of the ground in the district west of Fresno, where it can be used for irrigation. Repeated analyses show that even the most concentrated of the drainage waters from this tract would not be injurious when so used if the land is properly underdrained. The main tile will be laid in approximately straight lines, increasing in size up to 24 inches in diameter. On the fields badly charged by alkali further drainage by 4-inch, 5-inch, and 6-inch tile laterals may be necessary, but such fields are comparatively few. The cost of this system, calculated on a basis of 20,000 to 26,000 acres, should not exceed $10 per acre. The work of the federal experts legitimately ends with the demonstration now being completed on the Toft-Hansen tract. The formation of the district and the building of drains and the reclamation of land will rest entirely with the voters and the owners of the land.

A PREVENTIVE OF FOREST FIRES.

SUGGESTIONS FOR THE ADOPTION OF A SPARK-DEFLECTOR WHICH WILL REMOVE SOME OF THE MENACE WHICH THE RAILROADS HAVE FOR THE WOODS DURING DRY SEASONS.

BY

BRISTOW ADAMS.

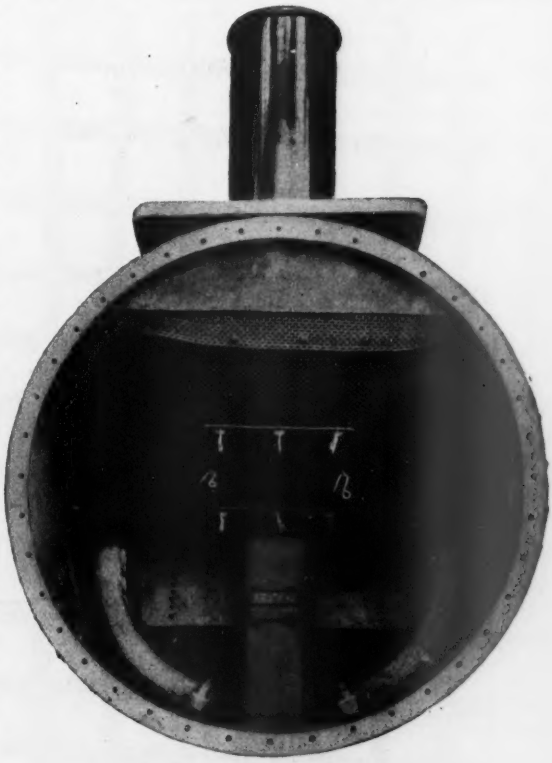
IT is admitted by all who have studied the problem that a majority of the forest fires in the United States are directly traceable to the railroads which traverse long wooded stretches. Several causes tend toward this state of affairs; careless track crews leave their campfires burning, or, in destroying old material by burning along the right of way, allow the flames to get into the surrounding forests; but the most prolific cause of all is the shower of sparks which are

Half-tones used by courtesy of New York Forest, Fish, and Game Commission.

thrown high into the air from the locomotive itself, and, carried by the wind, alight at some distance from the line, there to start a fire which may result in the loss of millions of dollars.

Various remedies have been suggested and devised, but they are not real remedies. Legal pressure has been brought to bear, and in many places, notably on the railroads which traverse the Adirondacks, spark-arresters are required by law; but the terrific fires which raged along these lines last year are sufficient proof that the spark-arrester belies its name.

This arrester consists generally of a coarse screen so placed that all cinders which are drawn through the fire tubes in the boiler must come in contact with it in their course toward the smoke-stack. Most of the iron netting used has a mesh not finer than two and one-half openings to the linear inch, or five-sixteenths of an inch square, and railroad men say that the steam-making capacity of an engine is crippled by using a mesh of smaller size; yet live coals as large as a pea can be thrown by the exhaust through a screen of this size. The screens are not placed in the stack, as many suppose, but are bolted firmly in the forward extension from the boiler, under the stack.



FRONT VIEW OF OPEN SMOKE-BOX, SHOWING IN ORDER FROM BOTTOM, ENDS OF FLUES, LOWER PART OF DEFLECTING PLATE, AND WIRE SCREEN.

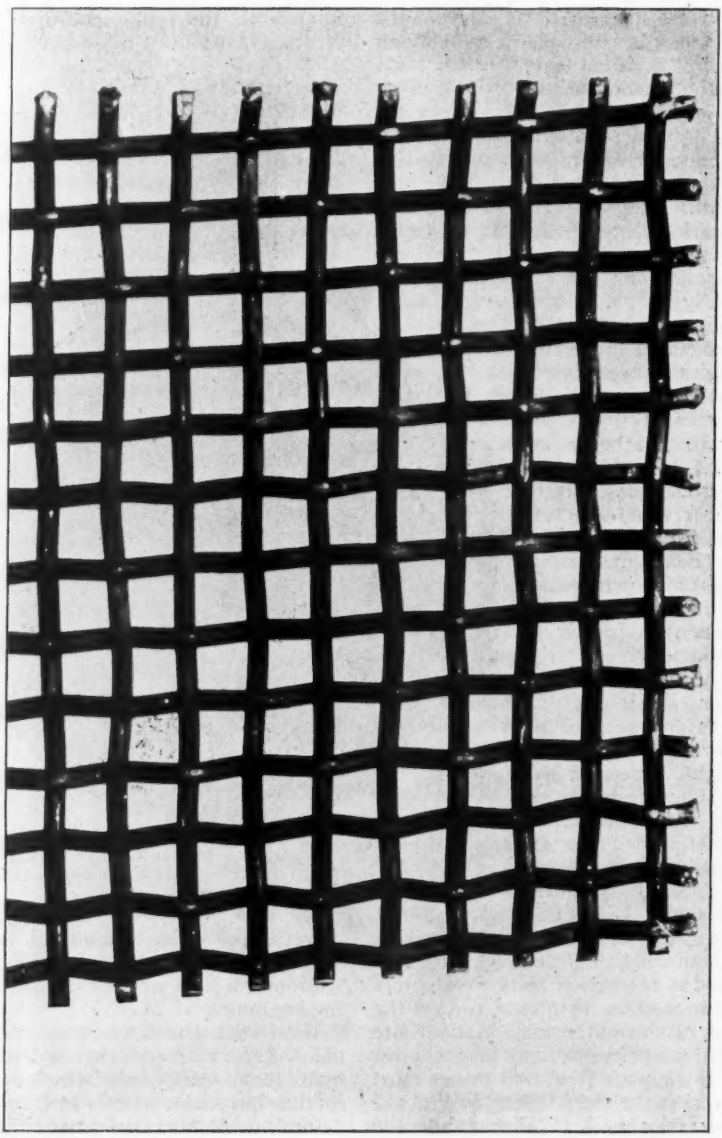
The sparks and live coals first strike a solid iron deflecting plate, which slopes forward at an angle of forty-five degrees and causes them to glance toward the bottom of this extension. Such as are carried up by the draft around the lower edge of the plate (and that means most of them) strike the wire screen, and the smaller ones pass through, while the larger ones drop back at the very front of the boiler extension cylinder, to be raked out at the end of the trip.

The seasons for forest fires are the spring and fall, and it has been found through long observation that all of the large fires occur during one or the other of these two seasons, with the preponderance in the fall, especially in the Western states. In the Eastern states, however, the spring is almost as dangerous a season as the fall, and last year's Adirondack fires were in full swing by the beginning of May.

Now, with the fire season upon us, and the spark-arresters avowedly inadequate for the purpose for which they are intended, it seems wise to look for some device to aid them in performing the work for which they were designed.

The writer of this article suggests a device well known and widely used by railroads in the West, but for a different purpose. It is used, for example, by the Union Pacific as a protection to the snow-sheds through which the road runs for many miles, particularly in crossing the Sierras.

The device itself is simple in construction and operation, inexpensive, and adaptable to any style of locomotive. It consists of a specially constructed

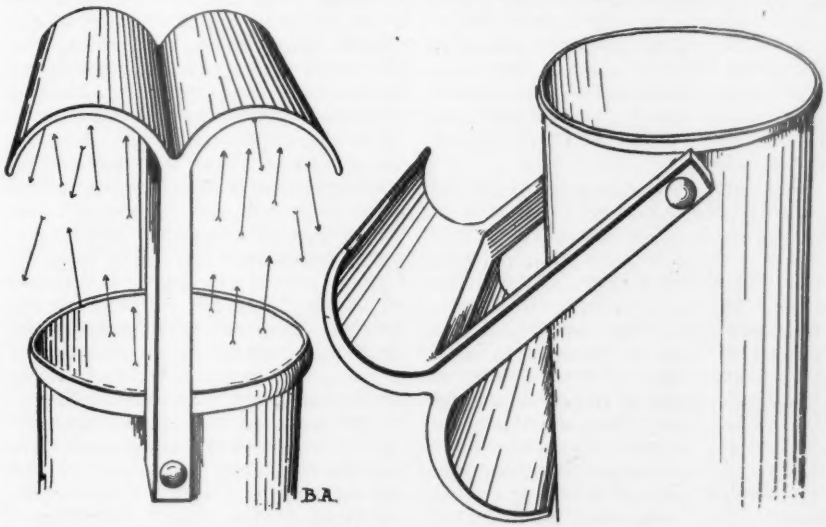


ACTUAL SIZE OF MESH COMMONLY USED IN STANDARD PRACTICE.

hood, which is held above the stack at a height of about two feet, and interferes but little, if at all, with the draft. The protection afforded consists solely in deflecting the sparks downward as they come out of the stack, thus preventing them from lodging in the roof of the snow-shed, and making them fall harmlessly on a road-bed free from inflammable material. With the rules generally in force as to the clearance of the road-bed and right of way of all combustibles, it seems that this device should be effective for use in forested areas. The sparks deflected upon such a right of way would expire harmlessly, and even in the seasons of highest wind it would be practically impossible for them to roll far enough to one side to get into the dry brush of the forest without being checked by some obstruction.

A front elevation of the hood is like a letter T, with a downward curved top bar, the drawings here presented giving a fair idea of it and its use in connection with the stack. It is made of iron, of course, and a spring notch holds it in its upright position. When not in use it lies at the side of the stack as shown, thus allowing it to be instantly thrown out of use to improve the draft in places where there is no forest, though it would seem that the draft necessary to run the heavy trains which cross the great divides where deflectors are used can not be very seriously impaired, considering the power developed.

The trial of some such device is suggested particularly for the Adirondack region of the State of New York, where so much depends on the protection of the woods from fire. The deflector may not be as valuable a thing for forest protection as it is to guard the snow-sheds from fire. In short, it is put forward as an untried possibility in the use now proposed, but as a suggestion in which there may be some value, even if it serves only to start other minds toward devising some safeguard more effective than spark-arresters alone have proved.



DIAGRAMMATIC DRAWING OF SPARK-DEFLECTOR IN USE ON WESTERN ROADS; FRONT VIEW IN POSITION, AND OUT OF USE.

NATURAL FOREST EXTENSION.

A STUDY OF THE TENDENCY OF FOREST TREES TO ENCROACH UPON THE PRAIRIE IN NORTHEASTERN KANSAS.

BY

C. W. YODER.

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PONY CREEK flows across the northwestern part of Brown county, Kansas, and empties into the Nemaha River south of Falls City, Nebraska. For the past fifteen years the home of the writer has been on the banks of this stream, and it is here that he has had opportunity for study of the forest conditions of the region.

The timber belt along the creek varies from zero to a quarter of a mile or more in width. The forest growth consists of a mixed stand of oak, elm, walnut, hickory, box-elder, cottonwood, maple, sycamore, basswood, wild cherry, and a number of other species. A few cottonwood and sycamore trees have attained a diameter of three feet or more. Occasional stumps of oak, walnut, and elm indicate that these trees attained a similar size. A white elm stump forty inches in diameter was found to contain two hundred and seventy-five annual rings. These veterans of the forest are confined almost exclusively to the vicinity of the creek bank. The great majority of the trees are of a comparatively recent growth.

There is a marked contrast between the forest growth along the creek and that along the Nemaha River, at the creek's mouth, or the Missouri River a few miles farther east. Along the Nemaha River there are considerable areas of a stand of mature trees. Their trunks are long and free from limbs for thirty or forty feet, a feature that is even more marked in the timber belt that skirts the Missouri River. Along the creek the trees are young and vigorous. Examples of recent forestation are numerous.

On one farm there is a fifteen-acre tract composed almost exclusively of black walnut trees from six to fifteen inches in diameter and about forty feet in height. An examination of a number of recently cut stumps indicates an age of from twenty-five to thirty-five years. The hazel brush and other shrubbery has not been completely suppressed by the encroaching forest growth.

On the opposite side of the farm, about sixty rods from the creek, a steep northern slope is covered with a dense stand of bur oak, red oak and jack oak, interspersed with basswood, wild cherry, honey locust and elm. The trees are from six to twelve inches in diameter and from thirty-five to forty feet in height. The stand is so dense that the smaller and weaker trees are being suppressed. By an examination of a large number of recently cut stumps the age of the trees was found to range from twenty-five to thirty-five years. Only one tree was found that contained forty annual rings. The age of the trees, the vigor of their growth, the complete absence of old stumps or other evidences of an older timber growth, all indicate recent forestation. Later this opinion was confirmed by an old settler, who stated that thirty-five years ago the slope supported a growth of prairie grass, dotted here and there with clumps of ground oak and hazel brush and an occasional small tree. At the present time the timber line extends to the crest of the ridge. The long, rocky, southern slope contains numerous clumps of hazel brush and ground oak. In these clumps vigorous young oak, elm, honey locust, and box-elder trees have obtained a foothold. Cattle and horses have ranged this land freely for years, but they do not seem to have interfered seriously with the timber growth. It seems to be but a question of a few years until

the forest area will extend across this slope also.

Another tract between two "draws" that converge at the timber line is being covered with a growth of white and red elm, green ash, black oak, bur oak, wild cherry and sycamore. In places as many as twelve or fifteen trees are found on a single square rod. In size they vary from mere sprouts to fifteen or twenty feet in height. In a few years the smaller trees and underbrush will be suppressed and true forest conditions will prevail. The forest area is being extended up this ridge a distance of forty rods beyond the timber line of fifteen years ago. At that time the tract was fairly well covered with a growth of hazel brush, ground oak and sumac. This tract has been browsed over continuously by horses and cattle (for the past eight years by sheep also) but they have not been able noticeably to check the timber growth.

Two miles farther downstream there is a tributary a couple of miles in length. It is skirted by a vigorous growth of young timber, in which oak and walnut predominate. At places the timber belt is fifteen to twenty rods in width. An old settler informed me that thirty-two years ago, when he took his claim, there were only a few scattering trees along the stream. From personal observations of the writer and from the testimony of old settlers, it seems beyond question that along the creek and its tributaries the forest area has increased several fold since the first settlements were made, about thirty-five years ago.

But it is not alone along the streams that the tendency to an increase of forest areas may be noted. On the home farm a lot of worthless plum trees were allowed to stand as a windbreak. They are being supplanted by box-elder, elm, and wild cherry.

On an adjoining section a small rocky knoll is enclosed in the corner of a cornfield. An old wagon trail, several cattle paths and a former haystack have killed the virgin sod at these places. Clumps of elm and honey locust have taken possession, and the trees have attained a height of twelve to fifteen feet.

More remarkable still are the conditions that prevail along a steep, rocky hillside on the same section. The surface of the ground is liberally strewn with glacial boulders of quartzite, while in many places the rocky soil affords but a scanty foothold for the prairie sod. The land has been pastured for years. There are a number of old cattle paths and washed places. These have been taken possession of by white-elm, box-elder and honey-locust trees, while the sodded portion of the hill contains clumps of sumac and wild plum. The trees show evidence of severe browsing, but they seem destined to survive, as the crowns of many of them are now beyond the reach of stock. These instances suggest that the prairie sod has been an important factor in retarding the spread of forest trees.

For a distance of a mile there is an untrimmed hedge along the pasture referred to above. Between the hedge and the wagon track, there is a growth of sumac and wild plum. In this thicket has sprung a dense growth of elm, honey locust, box-elder, and wild cherry. A few of the trees have attained a height of twenty-five feet. From this they grade down to mere sprouts of a season's growth. In many cases these young trees are denser than a good stand of corn. While the timber growth has made unusual headway here, owing to the negligence of the land owner and the road overseer, there is a marked tendency for trees to spring up along the road side, fence rows and waste places everywhere. Even cultivated fields are not exempt from their attempts to obtain a foothold. I doubt whether it is possible to find a single farm in this section of the state that does not contain more or less evidence of the natural spreading of forest trees.

The forest conditions along Pony Creek that have been described somewhat in detail are not essentially different from those to be found along the other streams in the county. Personal observations have extended from the Missouri River westward to the Blue and southward to the Kansas River. In passing westward from the Missouri, there is a gradual restriction of forest areas and a decrease in the number of

species; but no feature of the forest conditions is more marked than the prevalence of young trees along the ravines and smaller streams, indicating a recent extension of the forest area.

From a comparison of the timber along the Missouri and Nemaha rivers with that of the smaller streams; from the comparatively rapid extension of forest areas along these streams and the recent forestation of their tributaries; from the abundant spreading of forest trees along road sides, fence rows, and waste places everywhere, the evidence appears to be conclusive that in northeastern Kansas the natural conditions are favorable to the rapid extension of forest areas.

FORESTRY AND IRRIGATION IN CONGRESS

A CALENDAR OF NATIONAL LEGISLATION PERTAINING TO CONSERVATION OF OUR WOODS, WATERS, AND PUBLIC LANDS.

February 29.

In the House: By Mr. Rodey: A bill (H. R. 13206) to amend an act entitled "An act appropriating the receipts from the sale and disposal of public lands in certain states and territories to the construction of irrigation works for the reclamation of arid lands."

March 1.

The House disagreed to the amendments of the Senate to the bill (H. R. 11825) making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1905.

By Mr. Humphrey, of Washington: A bill (H. R. 13291) for the protection of game animals, birds, and fishes in the Olympic Forest Reserve, in the State of Washington.

March 7.

The following message and the accompanying report were received:

To the Senate and House of Representatives:

I submit herewith the preliminary report of the Public Lands Commission appointed by me October 22, 1903, to report upon the condition, operation, and effect of the present land laws and to recommend such changes as are needed to effect the largest practicable disposition of the public lands to actual settlers who will build permanent homes upon them, and to secure in permanence the fullest and most effective use of the resources of the public lands. The subject is one of such great importance and great intricacy that it is impossible for the Commission to report in full thereon at this time. It is now ready, however, to suggest certain changes in the law as set forth in the accompanying report. I commend these suggestions to the favorable consideration of the Congress.

THEODORE ROOSEVELT.

WHITE HOUSE, *March 7, 1904.*

March 8.

In the House: By Mr. Lacey: A bill (H. R. 13631) to provide for the entry of agricultural lands within forest reserves.

Also a bill (H. R. 13632) to provide for the disposal of timber on public lands chiefly valuable for timber, and for other purposes.

Also a bill (H. R. 13633) to regulate the disposal of public lands released and excluded from public forest reservations.

March 9.

In the Senate: Mr. Fulton, from the Committee on Public Lands, reported adversely on the bill (S. 2993) to amend the first section of an act entitled "An act authorizing the citizens of Colorado, Nevada, and the territories to fell and remove timber on the public domain for mining and domestic purposes."

The bill (S. 2994) extending the privileges of the above mentioned act to citizens of Oregon, Washington, and California was reported without amendment.

In the House: A message from the Senate announced that, among others, the Senate had passed the bill (S. 3205) authorizing the Secretary of the Interior to acquire the title to lands within certain Indian reservations.

By Mr. Jenkins: A bill (H. R. 13673) to amend section 2 of chapter 426, U. S. Statutes at Large: "An act to authorize the President of the United States to cause certain lands heretofore withdrawn from market for reservoir purposes to be restored to the public domain subject to entry under the homestead law with certain restrictions," so that any isolated or disconnected tract or parcel thereof may be sold for not less than $1.25 per acre.

March 10.

In the Senate: Mr. Hansbrough introduced a bill (S. 4916) to provide for the disposal of timber on public lands, and for other purposes.

March 12.

In the Senate: Mr. Warren introduced a bill (S. 5009) providing for the transfer of forest reserves from the Department of the Interior to the Department of Agriculture.

In the House: By Mr. Reeder: A bill (H. R. 13867) to amend the act providing for national irrigation, approved June 17, 1902.

March 14.

In the Senate: Mr. Quarles introduced a bill (S. 5054) to provide for the disposal of timber on public lands chiefly valuable for timber.

Mr. Warren introduced a bill (S. 5055) providing for the transfer of forest reserves from the Department of the Interior to the Department of Agriculture.

March 16.

In the House: By Mr. Stephens of Texas: A bill (H. R. 14050) to subject the mineral lands within Indian reservations to location, operation, and entry.

By Mr. Mondell: A bill (H. R. 14052) prohibiting the selection of timber lands in lieu of lands in forest reserves.

Also a bill (H. R. 14053) providing for the entry of agricultural lands within forest reserves.

March 17.

In the Senate: Mr. Hansbrough, from the Committee on Public Lands, reported favorably, with amendment, the bill (S. 5054) providing for the disposal of timber on public lands chiefly valuable for timber.

The amendment was concurred in and the bill passed.

Senate bills 370, 932, and 4916, relating to the same subject, were indefinitely postponed.

Mr. Dubois, from the Committee on Public Lands, reported, with amendment, the bill (S. 3165) amending section 3 of the act of June 5, 1900. The amendment was concurred in and the bill passed.

This bill condenses the present law, and in case a homestead entryman has made an entry which he has been compelled, through no fault of his own, to relinquish, and for the relinquishment of which he has received no consideration, it allows him to make a second entry. Under certain restrictions, a man who has entered less than a quarter section may enter enough additional contiguous land to make 160 acres.

March 21.

In the Senate: Mr. Hoar introduced, by request, a bill (S. 5126) to create a colonization bureau and to provide for advances to actual settlers on the public domain.

In the House: A letter from the Secretary of the Interior, transmitting, with favorable recommendation, the draft of a bill relating to the settlement of certain lands released from withdrawal for forest reserves, was referred to the Committee on Public Lands.

March 22.

In the Senate: Mr. Gibson introduced a bill (S. 5168) to repeal the desert land act and the commutation provision of the homestead act.

March 23.

In the Senate: Mr. Dietrich introduced a bill (S. 5207) to amend the homestead laws as to certain unappropriated lands in Nebraska, and to authorize the leasing of grazing lands therein.

In the House: By Mr. Reeder: A bill (H. R. 14374) to amend the act providing for national irrigation, approved June 17, 1902.

March 24.

In the Senate: Mr. Fulton, from the Committee on Public Lands, reported favorably the bill (S. 4622) amending section 2305 of the Revised Statutes, which was passed.

This bill extends the rights of a soldier or marine so as to give him credit for the time passed in military service in taking up an additional quantity of land to complete his homestead entry.

Mr. Cockrell introduced a bill (S. 5231) to amend the act entitled "An act appropriating the receipts from the sale and disposal of public lands in certain states and territories to the construction of irrigation works for the reclamation of arid lands."

March 25.

In the House: By Mr. Daniels: A bill (H. R. 14417) to provide for the appropriation of the waters of the Colorado River for irrigation purposes.

March 30.

In the Senate: Mr. Nelson, from the Committee on Public Lands, reported without amendment the bill (S. 4401) to grant to the State of Minnesota certain lands for forestry purposes.

Mr. Clark, of Wyoming, introduced a bill (S. 5319) providing for right of way for irrigation and other purposes upon the public lands and reservations.

March 31.

The joint committee of the two Houses appointed to arrange the existing disagreement upon the various appropriations for the Department of Agriculture submitted a report with recommendations.

By one of these recommendations, all of which were agreed to, the appropriation for the Bureau of Forestry was reduced from the figure allowed by the Senate ($450,140) to $425,140.

RECENT PUBLICATIONS.

Key to North American Birds: Containing a Concise Account of Every Species of Living and Fossil Bird at Present Known, from the Continent North of the Mexican and United States Boundary, Inclusive of Greenland and Lower California. By ELLIOTT COUES, A. M., M. D., Ph. D. Fifth edition. Illustrated. Dana, Estes & Co., Boston.

There has recently been issued, in response to a very general demand among ornithologists, this fifth edition of the scientific masterpiece of the late Dr. Coues. In the nature of things, such a work can never be complete in every essential detail, for the ways of birds are, to a certain extent, past finding out. Dr. Coues himself supervised the issue of four editions of his great work, finding with the exhaustion of each print something to add to his previous writings on the vast subject. In his preface to the fourth edition, issued in 1887, he noted that the fruits of the "unparalleled activity" of the great numbers of workers then in the field were not sufficiently sound and ripe to warrant a recast of the "Key." He died in December, 1899, leaving the manuscript for this fifth edition finished, but in such shape as to offer serious difficulties in the publication, lacking his supervision. The services of Mr J. A. Farley were secured, and he has completed the task in a manner which the publishers believe would have been Dr. Coues' exact idea of a presentation of this crowning work of his life.

The work as thus prepared comprises two large volumes, with profuse, well-prepared illustrations. Mr. Fuertes' drawings, two being in color, add richly to the edition. It is appropriate that this great work, serving in its latest form as a monument to the scientist whose activities were so varied and so unremitting, should contain a memorial to him in fitting terms. This is supplied in the form of the address delivered November 13, 1900, at the eighteenth congress of the American Ornithologists' Union, Cambridge, Mass., by Prof. D. G. Elliot, who wrote from the viewpoint of one who had known Dr. Coues for nearly forty years most intimately, both as a scientist and as a man. Thus the work stands complete, a boon to bird-lovers and a gratification to those who were privileged to come within the circle of Dr. Coues' acquaintance, either personally or professionally.

FOREST FABLES.

HOW A BEAUTIFUL, IRIDESCENT DREAM OF WEALTH WAS RUDELY SHATTERED BY THE DICTUM OF SCIENCE.

WE like to print little things now and then about the doings of the scientific manufacturers in the old country, who, with their marvelous instinct for utilizing "all the hog except the squeal," turn shavings into antiseptic dressings for wounds and make electric insulation out of tiny chips, which in this country would go into the refuse-burner.

You can imagine, then, how attractive the following paragraph appeared in the pages of the canny and dignified *Transactions of the Royal Scottish Arboricultural Society:*

"ALCOHOL FROM SAWDUST.—At the recent Congress of Applied Chemistry, held in Berlin, Simonson, of Christiania, described a method of utilizing sawdust in the production of alcohol, which the *Country Brewers' Gazette* prints. About two tons of sawdust are boiled with sulphuric acid for three hours, the liquid matter being then extracted by pressure, neutralized, and left to stand for 18 hours to cool and clarify, and then fermented for four or five days. The resulting alcohol is afterward distilled and rectified, and, making ample allowance for loss in the latter operation, the yield of spirit is said to be about 2½ quarts per cwt. of sawdust. Trials with the method on a manufacturing scale are claimed to have demonstrated the possibility of working at a profit and of opening up a new industry in timber-producing countries, where enormous quantities of sawdust are annually wasted."

Here seemed a treasure indeed. What good news for the struggling American sawmill man, who bought stumpage years ago at $1.50 and now can get only $27 per M for his lumber. Hope for the "fourth great industry of the United States" after all. With this, and the tariff properly adjusted so that the Canadians can't compete, there might be a chance to create a few brand new lumber baronies, to the everlasting glory of the Star Spangled Banner.

"Timber-producing countries where enormous quantities of sawdust are annually wasted." That's us (U. S.) without a doubt. Why, up in the Lake States they built their towns on top of old sawdust piles because there wasn't any other place to put them near enough to the mills so the men could take their noon meal at home. They can't get rid of it except by burning it up, as it is against the law to throw it into the streams and the furnaces can only accommodate a limited number of tons per day.

Two and one-half quarts for every hundred pounds! Great Snakes! What sacred rage would not possess the souls of the veteran lumber-jacks to think how, all unwittingly, they had sent to the burners or the furnaces enough alcohol in the course of their lives to keep all the woodsmen of the country oblivious of worldly cares henceforward and forevermore.

And so the paragraph was carefully clipped and prepared for the March number of FORESTRY AND IRRIGATION.

But it came to pass that in the interests of good journalism the clipping was submitted to a certain wise man, the breath of whose nostrils is the reek of retort and test-tube.

And he, having examined, announced that he himself had made alcohol by that process some five and twenty years agone, and that in his learned opinion it would take considerably more sulphuric acid and labor than the alcohol would be worth In other words, that the cherished process of Simonson, of Christiania, was not worth a tinker's dam for commercial purposes, supposing that the method was quoted correctly.

The bright air castles collapsed. The potential sawdust barons continue to shovel their jag-laden by-product under the boilers, and thank the Lord they don't have to buy coal.

The bibulous lumber-jack girds up his loins and walks ten miles to get his jug filled whenever he needs alcohol.

The world moves on in the old way, using alcohol made from starch, in spite of Simonson of Christiania.

The man who hoped to revolutionize American methods by publishing Simonson's process sits sobbing softly to himself and reflecting on the perfidy of things in general and of foreign notes in particular.

Only Carrie of Kansas smiles.

She: Darling, if you should ever leave me, I know that I would pine away!

He: Don't you think it would be better to try to spruce up?—*Princeton Tiger.*

Whereupon the fir flew. She gave him a sounding box upon the ear, exclaiming, "You wretch! No dogwood treat a woman thus!" The teak-ettle grazed his head as he fled, and she heard hemlock an intervening door.

PUBLISHER'S NOTE

Mr. F. A. La Roche, the American agent for the world-famous Darracq motor cars, is one of the most conspicuous figures in the motor world today. Besides his business acumen, which enables him to furnish, in the Darracq, 75 per cent of all imported cars sold in America, he is an expert motorist and has himself set a number of records. He was a conspicuous figure at the Ormond-Daytona races, and the cups he has won will fill a large-sized cabinet; but, more than a business man and motorist, he is an engineering expert and an inventor of note, many of the best improvements on gasoline motor engines being due to his skill.

Of course, a large and important part of Mr. La Roche's success with the "Darracq" is due to the superiority of the machine, which has created a sensation at all automobile shows on account of the excellence of its design and workmanship. In fact, there is a standing offer of $10,000 for a reduplication of its chassis, which is the most perfect example of mechanism of its class which has ever been seen here.

The Darracq cars make records and win prizes, in the first place, and they lead in speed, strength, endurance, and general reliability. In touring, as in racing, the Darracq preponderates as a record holder, and thus has a value not alone in the specialized fields of speed or endurance, but in both, thus making it a general-utility machine of great worth. Of eight possible chances in the Darracq class in Europe in 1903, the Darracq captured six world's records, and in the voiturette competitions were ahead of all others. In America these cars hold no less than twenty records. For a machine for any purpose, on account of the different models made, the Darracq cars should be suited to any one. The headquarters of the American Darracq Automobile Company are in New York.

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The salaries of Foresters, Assistant Foresters, Inspectors, and Assistant Inspectors range from $1,200 to $2,400 per year. Actual and necessary traveling expenses to and from the scene of field work are allowed, and while in the field one dollar gold per day is allowed for subsistence.

There are a number of vacancies in the different grades, and good men are urgently needed for this interesting and important work.

The work of the Foresters is, to a large extent technical; that of the Inspectors more administrative and less technical.

Examinations will be held in different parts of the United States about July 1 and November 1. For detailed information apply to the Bureau of Forestry, Washington, D. C., or to the Bureau of Insular Affairs, War Department, Washington, D. C.

Foresters and Inspectors now in the Philippine forest service and having from two to three and a half years' service, find the work very attractive instructive, and healthful.

Copies of the Philippine Civil Service Manual may be obtained from the Bureau of Insular Affairs, War Department, Washington, D. C.

The reports, bulletins, and other publications of the Philippine Forestry Bureau should be read by all desiring to enter the service. Copies may be obtained by addressing the Forestry Bureau, Manila, P. I.

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The objects of the Association, as set forth in its Constitution, are as follows:

1. The adoption by the Federal Government of a permanent policy for the reclamation and settlement of the public domain, under which all the remaining public lands shall be held and administered as a trust for the benefit of the whole people of the United States, and no grants of the title to any of the public lands shall ever hereafter be made to any but actual settlers and homebuilders on the land.

2. The preservation and development of our national resources by the construction of storage reservoirs by the Federal Government for flood protection, and to save for use in aid of navigation and irrigation the flood waters which now run to waste and cause overflow and destruction.

3. The construction by the Federal Government of storage reservoirs and irrigation works wherever necessary to furnish water for the reclamation and settlement of the arid public lands.

4. The preservation of the forests and reforestation of denuded forest areas as sources of water supply, the conservation of existing supplies by approved methods of irrigation and distribution, and the increase of the water resources of the arid region by the investigation and development of underground supplies.

5. The adoption of a harmonious system of irrigation laws in all the arid and semi-arid states and territories under which the right to the use of water for irrigation shall vest in the user and become appurtenant to the land irrigated, and beneficial use be the basis and the measure and limit of the right.

6. The holding of an annual Irrigation Congress, and the dissemination by public meetings and through the press of information regarding irrigation, and the reclamation and settlement of the arid public domain, and the possibilities of better agriculture through irrigation and intensive farming, and the need for agricultural education and training, and the creation of rural homes as national safeguards, and the encouragement of rural settlement as a remedy for the social and political evils threatened by the congestion of population in large cities.

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Descriptions of properties must be given accurately and in detail, it being understood that they must stand a thorough examination.

The property to be placed in our hands only by the owner or duly authorized agent, who has authority to make negotiations for sale.

Under no circumstances will we knowingly accept property that is inflated in value or upon which an additional price has been placed over that asked in the vicinity where located, or to other customers.

The commission or compensation to us is to be paid only in the event of sale through our efforts, such compensation to be agreed upon in advance and a contract properly covering the same to be given us.

When property is placed in our hands for sale we shall ask a reasonable time in which to accomplish sale and a reasonable option on property when a customer is secured who desires time for inspection and examination of title.

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HARDWOOD.—5,000 acres in Tuscaloosa county, six miles from railroad; 40,000,000 feet hardwood. **$55,000** for timber; **$65,000** for fee.

ARKANSAS

MANGANESE ORE LANDS.—800 acres, half mile from R. R., analyzing 50 % metallic ore. Estimated to yield 800,000 tons at cost not to exceed $2 per ton, f. o. b. Fine investment. Particulars on application.

43,000 acres of timber land, a continuous body, located on both sides of a navigable river and convenient to 3 lines of railroads. Logging operations can be conducted all the year round at a very low cost. Labor cheap and plentiful. A large milling concern in this locality cuts and delivers logs from stump to mill for $1.50 per thousand. The timber is estimated to cut on an average of 26,000 feet per acre; some acres will cut as high as 80,000 to 100,000 feet. The character of timber per acre, estimated, to cut as follows: Oak, 6,000 feet; Gum, 5,000 feet; Ash, 2,500 feet; Pecan, 4,000 feet; Persimmon, 3,000 feet; Hackberry, 2,000 feet; Elm, 1,000 feet; Cypress, 1,000 feet; Locust, 1,000 feet; Tupulo Gum, 1,000 feet. This tract is unexcelled of its kind in the South. Full particulars, together with price and terms, furnished on application.

SHORTLEAF PINE.—1,350 acres in Cleburne county. Timber good size and thrifty. Average cut, about 6,000 feet. Total cut, 8,000,000 feet. Price in fee, **$11,000**.

HARDWOOD.—76,000 acres on both sides of the Ouachita River, in Union, Bradley, and Ashley counties, Arkansas, with splendid transportation facilities. It consists of hardwoods with a little Pine, and will cut an average of 6,000 feet to the acre. About 70% of this amount is White Oak, and the remaining 30% is divided between Red and Willow Oak, Pine, Cypress, and Gum. Disinterested individuals who have just returned from ranging this timber speak of it in the highest terms and say that as a milling proposition it is by all odds the best they have seen in the South. The average cut given above is based on a very careful and conservative estimate made of 69,000 acres, the balance having been made after the estimate was made. The soil is very rich and fertile and when ready for the plow will sell for more than is now asked for land and timber. **$5.50 per acre.**

HARDWOOD.—10,000 acres in Arkansas; on railroad and also navigable river flowing into the Arkansas. Will cut 10,000 feet per acre; large percentage White Oak; balance Red, Burr, Water, Post, and Overcup Oak, Ash, Gum, and Hickory. **Price, $5.50 per acre.**

CALIFORNIA

CALIFORNIA TIMBER

GROUP A.—5,000 acres sugar and yellow pine in Eldorado county; will cut 45,000 feet per acre. **$20 per acre.**

GROUP B.—2,000 acres yellow pine in Eldorado county; will cut 25,000 feet per acre, and 4,000 cords of wood on tract in addition; when cleared, the best deciduous fruit lands in the state. **Only $6 per acre.**

GROUP C.—4,640 acres of redwood in Mendocino county, on line of railroad; will cut 40,000 feet per acre; also Oregon pine, not estimated. **$20 per acre.**

GROUP D.—22,000 acres of redwood timber in Mendocino county; more than 400,000,000 feet now standing; railway to shipping point on ocean; this proposition includes mills in operation; capacity, 100,000 feet per day; net profits alleged to be $75,000 to $100,000 per annum. **Bargain at $450,000**

GROUP E.—12,000 acres redwood on Garcia River, Mendocino county; mill site and landing on ocean; will cut 40,000 feet per acre. **Price, $25 per acre.**

Cedar, pine, and spruce lands also for sale in unlimited quantities, particulars of which furnished on application.

FLORIDA

CYPRESS TIMBER.—Near the St. John's River, about 1,400 acres of good cypress timber; can be bought cheap for the quality; located in the midst of a forest of Long-leaf Yellow Pine, also at a reasonable price. Full particulars given on application.

FLORIDA PHOSPHATE LANDS.—A magnificent bed of high-grade phosphate rock, located on the railroad in east Florida. The bed is 20 acres in extent, quantity unlimited. Government analysis shows 74.29 %. The rock comes to the surface in most places and can be mined at a small expense. A splendid opportunity for investment. Can be purchased outright or bought on royalty.

LONGLEAF PINE.—114,000 acres. Southern Railroad crosses the northern part of this tract and whole tract lies very close to Charlotte Harbor. Owner claims tract will cut not less than 2,500 feet to the acre, and titles all right. **Price, $2.00 per acre**

LONGLEAF PINE.—20,000 acres in one body. Will cut 2,500 feet per acre of 8 x 8, 30 feet and upward, round timber, *i. e.*, has never been turpentined. Railroad crosses corner. If taken in one body, **price, $3.00 per acre**

LONGLEAF PINE.—16,511 acres—average cut, 3,000 feet; 11,520 acres—average cut, 3,500 feet; 5,760 acres—average cut, 3,500 feet; all located in one county, close together, on good water transportation and within easy reach of Corrabelle, Florida, where there are large sawmills. Can be handled as one proposition. Trees have not been turpentined. **Price, $3 25 per acre for whole tract.**

LONGLEAF PINE.—417,000 acres, estimated to cut 3,000 feet to the acre. **Price, $3.00 per acre.**

LONGLEAF PINE.—140,000 acres. This is guaranteed to cut 2,500 feet per acre. **Price, $2.50 per acre.**

LONGLEAF PINE.—53,000 acres located near Tallahassee, Florida. Will cut 3,000 feet **$3.00 per acre.**

LONGLEAF PINE.—500,000 acres, and can add 500,000 acres more, making one million acres in one solid body of virgin Pine and Cypress. **Price, from $2.50 to $3.00 per acre.**

CYPRESS.—180,000 acres. Tract faces on Gulf. Will cut 2,500 feet per acre, Longleaf Pine, and in addition owner claims 100,000,000 feet of the finest Cypress in the South. **$3.00 per acre in fee.**

KENTUCKY

95,000 acres of coal and timber land, in Pike county, Kentucky.

LOUISIANA

HARDWOOD TIMBER LAND.—175,000 acres alluvial land will be sold in parcels to suit purchaser at from $5 to $12 per acre. Can sell 100,000 acres in solid body. All soil is rich, and difference in price depends wholly on value of timber standing, which will cut from 3,000 to 6,000 feet per acre. To home-seekers, small tracts at $10 per acre; $1.50 down and balance in 3 and 5 years. Rice, sugar cane, cotton, and alfalfa are not grown to better advantage anywhere else in the state.

LONGLEAF PINE.—20,000 acres Longleaf Pine, southern Louisiana; on logging stream not far from railroad; another railroad surveying to build through it. This timber will cut all the way from 5,000 to 15,000 feet per acre. As a whole it will average 6,000 to 7,000 feet. Price with land, which is good soil for agricultural purposes, **$9 per acre.**

LONGLEAF AND SHORTLEAF PINE.—100,000,000 feet with double circular sawmill, planer, two-room standard dry-kiln, good sheds, 75 or 80 tenant houses renting for from $3 to $10 each a month; log road seven miles long laid with 35-pound steel rails, three miles more graded and right of way cut for ten miles, and in addition 7,000 to 10,000 oak ties. Mill has a capacity of 75,000 to 80,000 feet per day. Price, **$1.60** per thousand feet for timber, and at cost less reasonable shrinkage for mill and plant.

LOUISIANA—Continued

SHORTLEAF PINE.—700,000,000 feet of Shortleaf Pine. The Iron Mountain R. R. is now building directly through this tract. 8,000 acres of this tract are in fee-simple, which goes with the stumpage. The owner will sell all in one lot or in lots of 150,000,000 feet. The cut will average about 7,000 feet per acre.

SHORTLEAF PINE —12,000 acres. Will cut 7,000 feet of Shortleaf Pine per acre. Is directly on the Texas and Pacific R. R. Price, land and timber, **$7.50 per acre.**

HARDWOOD.—6,300 acres near Washington, La., one-half mile from railroad. Will cut 8,000 feet per acre; 4,000 feet White Oak, then Red Oak, Gum, and Ash. Bordered by navigable river; soil alluvial and very rich. **Price, $8 per acre.**

HARDWOOD.—33,000 and 17,000 acres, bordered by Tensas and Macon Rivers The main line of the Gould system is surveyed through this land. This is one of the best timber and land propositions in the South. Will cut 8,000 feet per acre of Oak, Ash, Gum, Pecan, and Cypress. **Price, $6 per acre.**

MISSISSIPPI

LONGLEAF YELLOW PINE.—40,000 and 8,000 acres of Longleaf Yellow Pine This is a fine tract of pine near the N. O. and N. E. R. R. Will cut 10,000 feet per acre of Longleaf Yellow Pine. Lies in comparatively compact body. Price of the 40,000 acres, **$24** per acre in fee-simple; of the 8,000 acres, **$16** per acre in fee-simple.

LONGLEAF PINE.—25,000 acres on railroad. Guaranteed to cut 8,000 feet per acre. Also sawmill and full equipment. **Price, $450,000.**

LONGLEAF PINE.—16,000 acres on Gulf & Ship Island Railroad. Will cut 10,000 to 12,000 feet per acre. **Price, $26 per acre.**

LONGLEAF PINE.—22,000 acres on Gulf & Ship Island Railroad. Will cut 10,000 to 12,000 feet per acre **Price, $26 per acre.**

LONGLEAF PINE.—10,000 acres. Will cut 8,000 feet per acre. One-half has been turpentined. **$9** per acre for that which has been turpentined, **$11** per acre for that which has not.

HARDWOOD.—38,760 acres, lying between the Yazoo and Sunflower Rivers, both navigable and here only ten miles apart. The Yazoo & Mississippi Valley Railroad crosses one corner of the tract. This tract is claimed by timber experts to cut 7,000 feet per acre of the usual hardwoods of this locality—oak, hickory, gum, ash, etc. **Price, $7.50 per acre.**

HARDWOOD.—6,000 acres within one mile of railroad. Estimated to cut 5,500 feet poplar, hickory, and white oak. **Price, $9 per acre.**

HARDWOOD —10,000 acres on new railroad. Estimated to cut 5,500 feet per acre, poplar and white oak. Land very rich, worth $20 per acre for farming when timber is removed. **Price, $11 per acre.**

HARDWOOD.—44,000 acres hardwood. Will cut 9,000 feet per acre, white and red oak, hickory, ash, gum, and cypress. Railroad runs through this tract. Price, **$7.50** per acre in fee-simple.

HARDWOOD.—100,000 acres hardwood on Yazoo & Mississippi Valley Railroad and Sunflower River. Virgin forest—oak, ash, gum, and cypress. Will cut 9,000 feet per acre. **Price, $10 per acre.**

NORTH CAROLINA

250,000 ACRES FARMING AND TIMBER LANDS.—First and second growth estimated to cut 350,000,000 feet of pine, 500,000,000 feet of gum, 75,000,000 feet cypress. Juniper estimated to cut 2,000,000 poles. Located on the Atlantic coast. Railroad and two rivers

70,000 ACRES PINE, CYPRESS, JUNIPER, ASH, AND GUM TIMBER in Eastern North Carolina. This property is located on two sounds which empty into the Atlantic Ocean, 100 miles south of Norfolk, Va. Exceptional water transportation facilities. The longest haul to water will not exceed four miles, and would require railroad and steam skidder. The timber is estimated by a practical timber expert to cut the following amount of merchantable lumber: 85,000,000 feet of Short Leaf N. C. Pine, 100,000,000 feet of Juniper, 15,000,000 feet of Cypress, 100,000,000 feet of Black and Sweet Gum. The timber rights on the above will be sold for one dollar per thousand, with ample time to remove same, or can be purchased in fee, together with 80,000 acres additional, suitable for game preserve or farming purposes, at a very small cost. This is probably the best investment in North Carolina for the money.

HARDWOOD.—20,000 acres of hardwood in Macon county. Will cut 8,000 feet. Six miles from railroad, now being built. **Price, $5.00 per acre.**

NORTH CAROLINA—Continued

HARDWOOD.—12,000 acres. Virgin forest of poplar, white oak, red and chestnut oak, hemlock, and some white pine. 1½ cords tan bark per acre. This property is at present 14 miles from the railroad, but the Southern Railroad is now building a branch which will pass through this tract. Will cut from 12,000 to 15,000 feet per acre, on a conservative estimate. **Price, $7.50 per acre.**

SOUTH CAROLINA

500,000,000 FEET OF CHOICE STANDING TIMBER.—In South Carolina, convenient to transportation both by rail and water, near tide water possessing fine harbor.

GROUP A.—Consists of 11,000 acres, estimated to cut 25,000,000 feet of cypress, as choice as grows in the South; 18,000,000 feet excellent short-leaf pine, 5,000,000 feet of cottonwood, 8,000,000 feet of oak, 3,000,000 feet of ash, balance of timber hickory, sycamore, elm, gum, etc.

GROUP B.—22,000 acres, estimated to cut 80,000,000 feet of choice cypress, 70,000,000 choice short-leaf North Carolina pine, balance of timber oak, ash, hickory, sycamore, gum, etc.

GROUP C.—14,000 acres, estimated to cut 30,000,000 feet of choice cypress, 15,000,000 of oak, 15,000,000 short-leaf pine, 8,000,000 cottonwood, 10,000,000 ash, balance hickory, sycamore, elm, gum, etc. If the above tracts are purchased outright the timber will cost less than one dollar per thousand.

TENNESSEE

COAL LAND.—3,000 acres Jellico coal land on main line of C. N. O. & T. R. R. in Kentucky, near Tennessee line. Mines are now paying net profit of $1 per ton to owner, and will pay more. Further particulars on application.

VALUABLE SLATE QUARRY.—We have for sale a valuable property in East Tennessee, containing over 2,000 acres of excellent timber land; in addition, however, to the timber there is upon the tract a deposit of remarkably fine slate. The slate is easily and cheaply quarried—splits thin, straight and smooth, and punctures without scaling. After thorough tests the best experts have pronounced it equal to any slate in the United States. The quantity seems to be inexhaustible.

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There is also a large storehouse, good dwelling and several cabins, besides other improvements, such as tram-roads, blacksmith shop, etc., all of which goes with the property. Immediately available is also a splendid water power of about 18 feet fall, strong enough to run a large manufacturing plant to economically handle both the slate and timber. This is reasonably accessible to railroads, and most of the year has water transportation to the Mississippi and Ohio rivers. The location of this tract gives it easiest and cheapest access to the Western market, an important factor in connection with the Western trade, which at present is supplied from more distant quarries. The reason for this property being placed on the market will be given any one interested in its possible purchase, and will be found satisfactory. We believe a bargain can be had in its purchase.

HARDWOOD.—20,000 acres hardwood, estimated to cut 8,000 feet per acre. Poplar, oak, lynn, chestnut, etc. **Price, $9 per acre.**

TEXAS

PINE.—50,000,000 feet Pine stumpage, south Texas. Splendid location for a mill. This tract of Pine is well blocked up and is nearly in a solid body, located within 20 miles of Beaumont, on one railroad and within 2½ miles of another.

WEST VIRGINIA

LIME AND CEMENT.—472 acres, containing coal, lime, and cement stone. Limestone 400 feet thick, cement rock 35 feet thick, and coal 4 to 5 feet thick. Plenty of timber on property. Plant ready for operation with modern machinery; railroad sidings on premises. For further details apply to this department.

SPECIAL, 20,000 ACRES OF TIMBER.—Spruce and hemlock; one-half will cut 20,000 feet to the acre, balance 12,000 feet. Modern sawmill, daily capacity 50,000 feet; planer, docks, trams, etc.; 10 miles standard gauge railroad, with engine, cars, steam loader, and skidder; 8 miles additional graded, with ties and rails on ground ready to lay. Storehouse, dwellings; in short, a modern lumber plant in daily operation on railroad, with good connections east and west. Apply for further particulars.

COAL LANDS.—10,000 acres coal lands, convenient to railroads; three veins, one 4½ feet thick, and without slate. Cheap. Send for particulars.

WEST VIRGINIA—Continued

TIMBER INVESTMENTS.—8,000 acres spruce and hemlock, on railroad; will cut 20,000 feet per acre. **$35 per acre.**

1,500 acres spruce and hemlock, 2 miles from railroad; will cut 25,000 feet per acre. **$37 per acre**

54,000,000 feet fine timber, on tract of 5,500 acres on Greenbriar River and C. & O. R.R.; will cut 20,000,000 hemlock, 10,000,000 white oak, 7,000,000 red oak, 8,000,000 chestnut oak, 1,000,000 white pine, and 8,000,000 poplar, birch, chestnut, linden, hickory, locust, etc. Profits on tan bark alone will pay for the land. **$18 per acre.**

COAL, IRON, OIL, AND TIMBER LANDS.—7,000 acres on main line Norfolk and Western. Coal developed already; timber worth $88,000; complete prospectus furnished.

2,200 ACRES (coal and timber) HEMLOCK, SPRUCE, CHERRY, AND ASH. Will cut 18,000 feet per acre. One-half is Hemlock, balance principally Spruce This tract is on the railroad and a navigable river, is magnificently timbered and underlaid with a Clarion seam of coal. The outcrop showing plainly over the property. It has not been developed as yet, the branch of the Wabash having but recently been completed. **Price, $40 per acre.**

2,000 ACRES, containing Hemlock, Spruce, Cherry, Ash, etc. One-half of this tract will cut 20,000 feet per acre. Balance will cut 15,000 feet per acre. This is a splendid timber proposition. Is on a railroad. Good ground for stocking. **$32 per acre.**

1,200 ACRES, containing Hemlock, Spruce, and Cherry. This tract is one mile from railroad. Will cut 18,000 feet per acre. **$28.**

19,000 ACRES OF HEMLOCK AND SPRUCE, in Pocahontas county, W. Va., being on a navigable river and also railroad. This tract is claimed to be the finest tract of Spruce and Hemlock in W. Va., and has been estimated to cut 15,000 feet per acre of Hemlock and Spruce, besides a large quantity of Ash, Cherry, Bass Wood, and Maple, not included in this estimate. With the exception of about two thousand acres, the whole tract can be lumbered at one operation. The ground is smooth and in excellent shape to operate. **Price, $30 per acre.**

2,500 ACRES OF TIMBER on both sides of a navigable river, located on two lines of railroad. Will cut 8,000 feet per acre; 3,000 feet Oak per acre. This is a good, desirable property and is accessible, as aforesaid, to two railroads, which is an item in shipping lumber. **Price, $15 per acre.**

8,000 ACRES SPRUCE AND HEMLOCK, on railroad. Will cut not less than 20,000 feet per acre. It is situated in the county of Randolph and lies for several miles on the railroad and a navigable river. There is a splendid lot of bark on this tract, and it will eventually pay the purchase price of land. This is one of the very best propositions we know of in Spruce and Hemlock. **Price, $35 per acre.**

1,500 ACRES. It is located about two miles from railroad, and except for the fact that it is not directly on the railroad the description is the same as preceding property, but if possible it is slightly better timbered. **Price, $37 per acre.**

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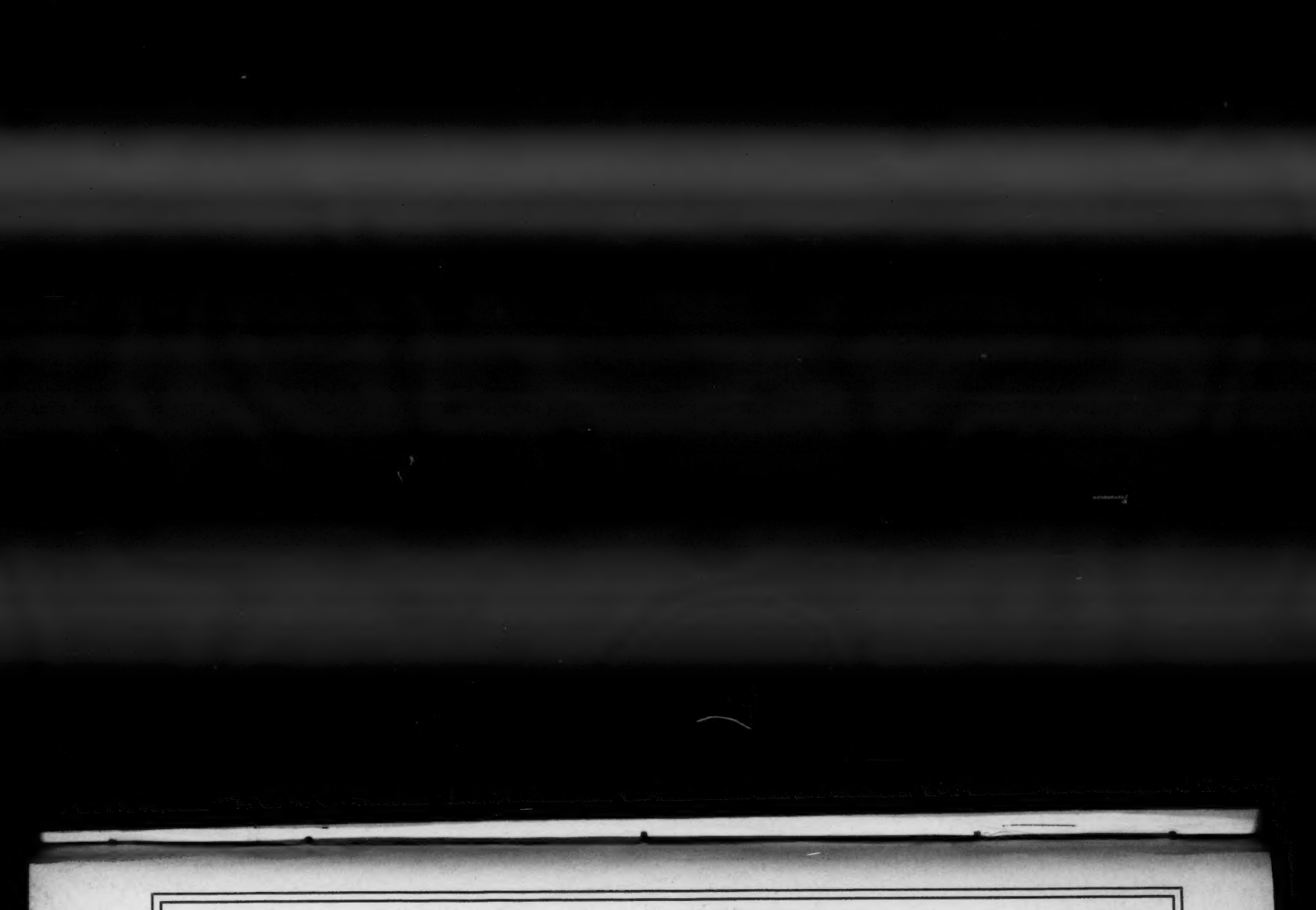
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